HORTICULTURAL ABSTRACTS.

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Abstracts. Initialled abstracts in the present number are by Dr. J. Scholz of the State Institute for Horticultural Research, Prûhonice, Prague, and by M. H. Moore, H. L. Pearse, W. S. Rogers and H. M. Tydeman of the East Malling Research Station.

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Horticultural Abstracts

Vol. VIII June, 1938 No. 2

MISCELLANEOUS.

*Growth promoting substances**

317. THOMAS, M. 577.15.04

External organic growth-promoting substances and green plants.

Sci. Hort., 1938, **6** : 178-90, bibl. 64.

The evidence is reviewed for and against the existence in the rooting medium of external, organic, growth-promoting substances, differing from nutrients in that their material value is of little or no importance in growth, yet affecting the rate at which a plant uses food and thus acting as external chemical stimuli possessing the power of exciting growth responses in plants. The stimulating substances have been reported as being present in living plant tissue, e.g. potato, humus, bacterized peat, horse urine and dung, farmyard manure, yeast and other micro-organisms, and in preparations containing folliculins and other animal hormones. The importance of the micro-organisms of the soil in producing these growth stimulants has often been emphasized. As yet, apart from experiments with certain animal hormones and a few synthetic substances for auxins none of the stimulations which have been observed can be with certainty ascribed to any particular chemical compound. Useful practical application of the results obtained is as yet not possible in view of the frequency with which a success with a given substance and plant by one investigator will prove a failure when the experiment is repeated by another, pointing to the existence of a complex of external factors not yet understood.

318. COOPER, W. C. 577.15.04 : 581.144.2

Hormones and root formation.

Bot. Gaz., 1938, **99** : 599-614, bibl. 14.

Estimations were made of the amount of auxin present in the bark of cuttings which had been treated with indoleacetic acid, using the chloroform extraction method and the standard *Avena* technique. It was found that 90% of the auxin disappeared during the first day. Very little auxin was recovered from the bark at the apex of cuttings which had been treated at the base with 0·001, 0·005 and 0·02% solutions of indoleacetic acid, but small amounts were recovered from the base when the cuttings were treated at the apex. There was little difference in the amount of auxin recovered from treated apple and lemon cuttings, but, whereas appropriate basal treatment greatly stimulated rooting in the lemon cuttings, roots were not induced on the apple cuttings by any treatment. It is suggested that apple cuttings are lacking in certain internal substances necessary for root formation. Some indications were obtained that leaves of lemon cuttings supply a substance necessary for the differentiation of root primordia, and another for their outgrowth. The former appears to be transported rapidly to the base under the influence of indoleacetic acid while the latter is transported slowly to the base. H.L.P.

319. WENT, F. W. 577.15.04

Specific factors other than auxin affecting growth and root formations.

Plant Physiol., 1938, **13** : 55-80, bibl. 28.

Auxin is not the only specific growth factor substance necessary for elongation of stems, apical swellings and root formation in pea seedlings, other hormone-like factors, namely calines, must

* See also 431.

also be present. Without caulocaline in the roots there is no elongation of stem or lateral buds, no root formation without rhizocaline and no leaf growth without phyllocaline. Auxin causes a redistribution of the calines and this enables polar root formation and bud inhibition to be further explained. The specificity in development, the decision as to whether under the influence of auxin roots will develop or growth in length or thickness take place depends on the relative concentration of the various calines. They belong to a new group of plant hormones and so far it has been impossible to handle them outside living tissue.

320. GOČOLAŠVILI, M. M., AND MAXIMOV, N. A. 577.15.04 : 634.322-1.535
Effect of heteroauxin in the rootage of cuttings from subtropical wood.
C.R. (Doklady) Acad. Sci. U.R.S.S., 1937, **17** : 51-4.
Cuttings from the trifoliate orange (*Poncirus trifoliata*) treated at the base with weak solutions of indoleacetic acid rooted 100%, and cuttings from the Unshiu tangerine (*Citrus Unshiu*) rooted up to 70%, whereas without such treatment cuttings of these plants rarely rooted. Cuttings taken in the spring responded to treatment more readily than those taken in the winter.
H.L.P.

321. HAVAS, L. 577.15.04
Colchicine, phytocarcinomata and plant hormones.
Nature, 1937, **140** : 191-2.
The growth of tumours in tomato plants induced by inoculations with *B. tumefaciens* was inhibited by a 1:10,000 aqueous solution of colchicine introduced through a cut in the stem. It is thought that this inhibition may be produced through the intervention of plant hormones stimulated by the colchicine. Other batches of similarly inoculated plants were treated in three different ways known to stimulate the growth of hormones, and in each case the growth of the plant tumours was similarly inhibited.

322. BLAKESLEE, A. F., AND AVERY, A. G. 547.944.6 : 631.523 : 577.15.04
Methods of inducing doubling of chromosomes in plants. By treatment with colchicine.
J. Hered., 1937, **28** : 393-412, bibl. 15.
The authors discuss various methods by which tetraploids are originated. It has been possible to recognize spontaneous tetraploids in *Datura* at a very early stage from the swollen condition of the stem below the cotyledons. 4n and 2n cells may be found together in the same flower. Chromosome doubling was very common in the roots. The number of tetraploids occurring in garden cultures was found to vary with the season. Various treatments of the seed including radium, X-rays, heat and ageing of the seeds were tried, but, although mutations were induced, no tetraploids were found. Attempts were made to induce chromosome doubling by the use of chemicals. Chloral hydrate inhibited germination at a concentration of 6·4% when the seeds were immersed in it for ten days. None of the chemicals tried except colchicine induced tetraploidy. When seeds were heavily treated, plumule growth was checked, shoots developed from the axils of cotyledons and buds were abnormally arranged. Following the treatment with colchicine, sectors were formed with roughened leaves characteristic of 2n and 4n tissue and similar to the spontaneous 4n mutants. It has been shown in *Datura* that where a seed is treated with a given stimulus only a part of the initial cells which develop into the shoot undergo mutation. These mutated cells give rise to mutated sectors in the adult plant. Treatment of seeds was found to be the most satisfactory method of using colchicine for the induction of tetraploids. A series with 50 seeds each treated with 0·4% solutions for 1, 2 and 4 days gave plants with 56, 94 and 100% ± 4n tissue as determined by appearance. It is suggested that increased temperatures during treatment may increase the proportion of 4n branches. These experiments were made with the authors' standard Line 1 Jimson Weed (*Datura Stramonium*) but studies on certain other species are also described. Other methods of using the colchicine such as immersing twigs or branches, solutions in 0·8% agar, mixtures with lanolin, the use of

a capillary string, the application of single drops to buds repeated at intervals and atomizing are suggested. The authors consider that one of the most important uses of chemical methods of inducing chromosome doubling will be in making double diploids out of sterile species hybrids. Such doubling of chromosomes is about the only well-established mechanism known among plants for the evolution of species. Double diploids from sterile hybrids will be of economic importance since they should establish pure breeding races with hybrid vigour and the desirable characteristics brought about by tetraploidy. H.M.T.

323. BONNER, D. M. 577.15.04
Activity of the potassium salt of indole-3-acetic acid in the *Avena* test.
Bot. Gaz., 1937, **99** : 409-11, bibl. 3.

In several experiments it was found that the three substances indole-3-acetic acid, potassium indole-3-acetate and sodium indole-3-acetate possessed similar activities when their equimolar solutions, buffered at the same pH, were given the *Avena* test. Thus, as would be expected from theoretical considerations, these three substances, if buffered at the same pH, possess the same activity. In the case of the unbuffered solutions it is suggested that the difference in activity may be due to a pH effect. [From author's summary.]

324. DAGYS, J. 577.15.04
The nature of yeast growth substances. [Lithuanian, German summary.]
Mem. Fac. Sci. Univ. Lithuanie, 1937, **11** : 453-71 +4 pp. summary and bibl. 34.

Chapters 3-7 contain a condensed account of results published in *Protoplasma*, 1937, 38 : 205-9. The following investigations were also made to determine the nature of the yeast growth substance.

1. Gluten proteins of wheat meal, dried and powdered, were extracted for 15 hours at a temperature of 50° C. to 55° C., some in active, some in boiled 0·5% papayotin solution, and some suspended in water. The water extract had little effect on yeast, but the gluten extract obtained from the active papayotin solution showed marked growth promoting influence ; the extract from the boiled papayotin solution shows itself intermediate between the two in its effects (Table X). From this it follows that through proteolysis and by means of papayotin yeast growth substances can be released from proteins. Merck's papayotin preparation is just as rich in growth substance. Yeast growth substances are thus protein dissociation products.

2. A further test was made to determine whether tyrosine and cystine have any effect as yeast growth substances, in view of their effect in promoting cell division noted by Orsós in 1936 and Hammet 1929. Trial of the effect of these amino-acids on yeast was made both by adding them to synthetic and to weak yeast solutions containing growth substance. Neither had any effect when added to synthetic yeast solution. When, however, added at the same time as extract of maize leaves tyrosine showed a slight growth promoting effect in doses of 2-50 mg. per 100 c.c. nutrient solution (Table XII), and this should be regarded as a nutrient effect. Cystine did not promote production of yeast substance even in a nutrient solution containing bios (Table XII).

3. Vitamin B1, as Merck's betabion, added to yeast nutrient solution in doses of 0·001-0·5 mg. per 100 c.c., showed no effect as a growth promoting substance on yeast strains. Betabion was also without any such effect in doses of 0·05-0·2 mg. per 100 c.c. in a nutrient solution containing bios (Table XIII). This shows that vitamin B1 has not aided the growth promoting effect of *Zea Mays* extract.

4. Yeast growth substance may, according to Gromakovsky (1936), be regarded as a type of vitamin basis of the proteins. It is always more prevalent in those places where protein constituents are frequent, e.g. at the synthesis of proteins in embryonal tissues, at the breakdown of proteins in dying organs and at the mobilization of reserve proteins in germinating seeds of the *Gramineae*.

325. DAGYS, J. 577.15.04
Die Hefewuchsstoffe in Maiskeimlingen. **(Yeast growth substances in maize seedlings.)**
Protoplasma, 1937, **28** : 205-29, bibl. 39.

1. The aleurone layer of dormant maize seed contains almost the same concentration of bios growth substance as the scutellum, whereas the pericarp and the starch endosperm contain mere traces. 2. 5-6 day old maize seedlings contain the highest concentration in the primary leaves. Coleoptile and root tips contain more growth substance than the parts immediately behind them. The root contains only about $\frac{1}{2}$ to $\frac{1}{3}$ the concentration of rootgrowth substances contained in the aerial parts of the seedling. 3. In plants a month old the roots contain a concentration about 4 times smaller than the aerial parts. A comparison of contents in individual leaves shows that the youngest growing leaves and the oldest leaves which are dying off have the greatest concentration of growth substances in them and leaves in the stage between these two extremes have the least. 4. Light helps growth substance synthesis in the aerial parts of maize seedlings. Despite this the growth substance concentration in the shoots was not depressed by keeping old green maize plants in the dark for 3-4 weeks. 5. The growth substance content of the plant material is doubled by autolysis. Autolysis, or rather proteolysis, released a part of the bios growth substance from its combined state. This accounts for the increase in root substances in dying leaves and coleoptiles. Autolysis releases much smaller amounts of growth substances from maize seedlings grown in the dark. 6. A small amount of bios growth substance is produced by exosmosis on soaking maize roots for some hours in distilled water. 7. Bios growth substance should be regarded not as a catalyst but as a hormone-like or vitamin-like base of living substance.

326. VAN OVERBEEK, J., AND WENT, F. W. 577.15.04 : 635.656
Mechanism and quantitative application of the pea test.
Bot. Gaz., 1937, **99** : 22-41, bibl. 9.

If growing stems of pea seedlings are split and immersed in a solution containing auxin, the two halves will curve inwards in a curvature proportional to the logarithm of the auxin concentration. The curvature is due to differential growth. The epidermis of the split stems grows faster than the wounded inside because the auxin is unable to enter the stem through the wounded surface. The pea test can be successfully used for quantitative auxin determinations, the technique of which is described. The pea test curvature is dependent upon the pH of the auxin solutions in that, the higher the acidities, the greater the curvatures obtained. The sensitivity of the pea stems to auxin has a daily and seasonal variation. The rate of curvature is independent of the auxin concentration, but the higher the concentratiom the longer the period during which the curvature proceeds. Certain advantages are possessed by the pea test over the standard *Avena* test. These are :—(1) large range of concentrations in which the effect is a function of the concentration, (2) humidity need not be constant, (3) curvature reaches a maximum in from 4 to 12 hours (according to the auxin concentration) and thereafter does not change, so that the test can be measured at any time between 12 and 60 hours, (4) no lack of sensitivity, if occasionally exposed to small amounts of white light. Disadvantages of the pea test are :—(1) it requires 20 c.c. of the active solution compared with the less than 1% necessary with *Avena*, (2) it is less specific in its reaction, so that a large number of substances, giving in *Avena* only a very slight reaction and only in high concentrations, are active in the pea test. This property has been turned to distinct advantage and has enabled a completely new attack to be made on the problem of the relation between chemical structure and physiological activity,* (3) it is not so quantitative as the *Avena* test.

327. ISAAC, W. E. 577.15.04 : 664.85.23 + 664.85.22
Growth inhibiting emanation from peaches and plums.†
Nature, 1937, **140** : 1027.

Air passed over certain ripening varieties of peaches and plums was found to exercise a marked effect on broad bean (*Vicia Faba*), sunflower (*Helianthus annuus*) and Canadian Wonder bean

* Koepfli, Thimann and Went. (In Press.)
† From note on Proceedings of the Royal Society of S. Africa, October 20, 1937.

(*Phaseolus vulgaris*). The effects, which are attributed to the evolution of ethylene, were retardation of length growth, increase of thickness due to an increase in the size of the cortical cells, decrease of total amount and changed reaction to gravity.

328. SÖDING, H. 577.15.04
Wirkt der Wuchsstoff artspezifisch ? (**Is the effect of a growth substance different with different species ?**)
Jb. wiss. Bot., 1936, **4** : 534-54, bibl. 14.

The effect of growth substance does not vary with different species. It is admitted that preparations of growth substance from plant parts in which the presence of growth substance might be expected show little or no reactions in the *Avena* test, whereas in the *Cephalaria* test they result in pronounced curvature. This, however, does not show any qualitative difference in the growth substance, but merely a very low concentration of the substance, which can therefore only be detected by the very delicate *Cephalaria* test. The S-shaped rise of the curve of effect (dependence of size of curvature on concentration of growth substance) makes the use of the *Avena* test difficult for the detection of small amounts of growth substance. The best sources of growth substance in plants are young leaf shoots and flower buds, as well as unripe fruits sometimes (e.g. *Cephalaria*), but not always (e.g. *Heliopsis*). Old leaves and open flowers yield very little growth substance. Growth substance may be present in considerable amount in washed out stems (noticeably so in *Heliopsis*) or absent as in *Cephalaria*.

329. BOYSEN JENSEN, P. 577.15.04
Über die Verteilung des Wuchsstoffes in Keimstengeln und Wurzeln während der phototropischen u. geotropischen Krümmung. (**Distribution of growth substances in seedling stems and roots during phototropic and geotropic curvature.**)
Biol. Medd., Kbh., 1936, **13** : 1-31, bibl. 12.

A new method is described for determining growth substances in plants. The growth substance is extracted by Thimann's method with chloroform, carried over by means of a special apparatus into a known quantity of agar and quantitatively determined, using *Avena* as testing object. 2. This method was used to investigate the distribution of growth substance during the geotropical curvature of the epicotyl in *Phaseolus* and *Vicia Faba*. The concentration of growth substance was found to be greater on the under than on the top side. 3. In the same way the concentration of growth substance is greatest on the posterior side during the phototropic curvature of the epicotyl of *Phaseolus*. 4. It was possible to show that the growth substance of the root is not transferred there from above, but is formed in the root tip. The amount of growth substance which can be collected with agar in 20 hours is about 20 times as great as the amount which at any given time is present in the root. Removal of the root tip causes a decrease in growth substance in the upper part of the root. In the author's opinion the assumption of an acropetalous root substance flow has inadequate support. 5. During geotropical curvature of the root the growth substance concentration is greatest in the lower side. 6. Whereas the difference between growth substance concentration in the top and bottom sides of the roots of *Vicia Faba* is sufficiently large to explain the difference in growth of the two sides during geotropic curvature, that in the epicotyls of *Vicia Faba* and *Phaseolus* is much smaller than one might expect from the changes in growth. Hence it is probable that the growth substance, as suggested by Bonner, occurs partly in a wandering and active state and partly in a stationary and inactive state. The activity may be dependent on the distribution between the different phases within the cell. Possibly growth substance may become inactivated by combining with other substances.

330. SCHOLZ, J. 577.15.04 : 631.535
Vliv indol-3-octové kyseliny na zakořeňování letních řízků některých okrasných dřevin. (**Influence of indole-3-acetic acid on rooting response of summer cuttings of some ornamental trees and shrubs.**) [English summary.]
Ann. Acad. tchécosl. Agric., 1937, **12** : 648-59.

Cuttings of 100 plant species were treated with 0·001 to 0·02% solutions of indole-3-acetic acid for 24 hours. Twenty-three cuttings and varieties gave a 100% positive response. Thirty-four

gave distinctly positive results, eight gave a slightly positive reaction, four were negative and thirty-one refused to root both with and without treatment. Applied at optimum concentration, which varies according to species and variety and probably according to the stage of maturity of the shoots or branches concerned, heteroauxin increases both number and length of roots made per cutting. It is found specially useful for the propagation of magnolias, syringas, etc., by cuttings. J.S.

331. KRAUS, E. J., BROWN, N. A., AND HAMNER, K. C. 577.15.04 : 635.652
Histological reactions of bean plants to indoleacetic acid.
Bot. Gaz., 1936, **98** : 370-420, bibl. 14.
The response is described of the living cells of Red Kidney bean to applications of indoleacetic acid in lanolin (30 mg. indoleacetic acid per gram of lanolin). The histological developments following the application of indoleacetic acid closely resemble many of those associated with crown gall produced by *Bacterium tumefaciens*. There is a great speeding up of nuclear division especially in cells near the surface of application, resulting in a multinucleate condition of many of the cells. Later cell-division occurs and the derived cells may remain meristematic for long periods of time. The paper is illustrated by 33 figures.

332. HAMNER, K. C., AND KRAUS, E. J. 577.15.04 : 635.652
Histological reactions of bean plants to growth promoting substances.
Bot. Gaz., 1937, **98** : 735-807, bibl. 7.
A further series of studies (see previous abstract) on the histological responses of the bean to the terminal application of 30 mg. indoleacetic acid per gram of lanolin to decapitated stems, to the same mixture applied in a narrow band completely encircling uninjured internodes, to the slightly abraded surfaces of young pods along the adaxial suture and over the cut terminal surfaces of similar pods. Two additional substances, indolebutyric acid and naphthalenacetic acid were also used in mixture with lanolin. There are 53 figures illustrating the responses obtained.

333. MITCHELL, J. W., AND MARTIN, W. E. 577.15.04 : 635.652 : 581.192
Effect of indoleacetic acid on growth and chemical composition of etiolated bean plants.
Bot. Gaz., 1937, **99** : 171-83, bibl. 5.
The object of the investigations was to study the effect of 3% β-indoleacetic acid on the chemical composition of the plants treated with it. Histological responses shown by treated regions of plants grown in continuous darkness closely resemble those shown by plants of comparable age grown under alternating light and darkness as reported by other workers. Histological differences between treated and untreated plants grown in continuous darkness were very great. The application of indoleacetic acid to the first internode of etiolated plants retarded the transport of materials from the cotyledons and also the uptake of water by the plants. Analysis showed that indoleacetic acid greatly affected the direction of transport of materials from the cotyledons. These did not pass beyond the point of treatment (i.e. first internode), but transverse sections through the treated portion of the etiolated plants showed no apparent evidence of mechanical blockage or inhibition of development of the conductive tissues.

334. MITCHELL, J. W., AND HAMNER, C. L. 577.15.04 : 635.652
Stimulating effect of beta-3-indoleacetic acid on synthesis of solid matter by bean plants.
Bot. Gaz., 1938, **99** : 569-83, bibl. 10.
Dilute concentrations of beta-3-indoleacetic applied to the decapitated extremity caused bean plants with the axillary buds removed to gain 23-85% more solid matter than similarly mutilated, untreated plants. When the axillary buds were not removed, the treatment retarded their development. A greater amount of solid matter was synthesized by treated plants under a relatively high light intensity than under a relatively low light intensity.

335. BORTHWICK, H. A., HAMNER, K. C., AND PARKER, M. W. 577.15.04 : 635.64
Histological and microchemical studies of the reactions of tomato plants to indoleacetic acid.
Bot. Gaz., 1937, **98** : 491-519, bibl. 2.

Tomato seedlings were decapitated above the second lobed leaf and a mixture of 20 mg. indoleacetic acid in 1 g. of lanolin was applied to the cut surface. Internodes terminated by the cut surface enlarged (at the same rate as the internodes below) only if the cut surface had been treated with the mixture. The changes in the tissues of the stem occurring in response to the treatment are described and illustrated (20 figures). A ring of adventitious roots was found around the stem as a result of activity of the external phloem and another ring near the pith as a result of the activity of cells of the internal phloem and adjacent pith. Nitrates were more concentrated in the controls than in the treated stems and protein in the treated stems increased in those areas where cell divisions became most abundant. Starch disappeared from the treated stems as the tumours enlarged, but remained in the controls.

336. HARRISON, B. F. 577.15.04 : 586.63
Histological responses of *Iresine Lindeni* to indoleacetic acid.
Bot. Gaz., 1937, **99** : 301-38, bibl. 10.

Iresine was chosen because it has a markedly different anatomical pattern from either bean or tomato, on both of which much similar work has already been done. The technique follows the usual lines of smearing decapitated stems or banding internodes with 3% indoleacetic acid in lanolin. The responses are recorded and compared with those of other plants. The changes produced are illustrated in 19 figures.

337. GARDNER, F. E., AND MARTH, P. C. 577.15.04 : 581.145
Parthenocarpic fruits induced by spraying with growth promoting compounds.
Bot. Gaz.,* 1937, **99** : 184-95, bibl. 4.

Pistillate flowers of holly under greenhouse conditions were sprayed once with an 0·04% solution of indoleacetic acid before the flowers were open and when they had been open for 1, 3, 5 and 7 days respectively. All the open sprayed flowers produced parthenocarpic fruit but those in bud failed to do so, thus indicating that the stimulus is best transmitted through the pistil. When an aqueous solution of 0·006% of naphthaleneacetic acid was used several days after the corolla had completely withered and the flowers were ready to fall, the pedicels and pistils, which had become yellow, with the stigmas to all appearances unreceptive, became green again and fruits were subsequently developed. Comparative tests were made with several other growth substances in various concentrations and the results are tabulated. Four repeated sprayings at 24 hour intervals were more effective than a single spray. In any case this would be necessary in practice, as all the blossoms are not open at the same time. The rapidity with which fruit was set after spraying with naphthaleneacetic acid was much greater than that following pollination. In favourable conditions of growth a second flush may occur. When this happened all the sprayed plants dropped practically all their berries, but none of the pollinated plants dropped their fruit, although all made a second growth. Naphthaleneacetic and indolebutyric acids in the higher concentrations had an inhibiting effect on second growth. Some degree of fruit setting was also obtained by watering the soil with indoleacetic acid and by introducing small quantities of the dried powder into small holes bored in the stem. The same treatments applied to strawberries, apples and grapes were unsuccessful in producing parthenocarpic fruit, except that the strawberry occasionally responded but never with more than 1 fruit per truss.

338. BROWN, A. B., AND CORMACK, R. G. H. 577.15.04
Stimulation of cambial activity, locally in the region of application and at a distance in relation to a wound, by means of heteroauxin.
Canad. J. Res., 1937, **15**, Sec. C., pp. 433-41, bibl. 6.

Heteroauxin applied as a paste in lanoline (1 mg. per g.) to the apical end of disbudded cuttings taken from dormant leader shoots of balsam poplar during the winter stimulated cambial activity

* For briefer account see *Science*, 1937, 86 : 246-7.

for a distance of about one inch below the point of application. When the cuttings were bridge ringed some distance below the point of application, marked cambial activity was also evident around the ring, although no cambial activity had occurred over the intervening portion of the cuttings. H.L.P.

339. GRACE, N. H. 577.15.04
Physiologic curve of response to phytohormones by seeds, growing plants, cuttings and lower plant forms.
Canad. J. Res., 1937, **15**, Sec. C., pp. 538-46, bibl. 7.

The author reports increased growth of whole plants of several species by the application of phytohormones. (*a*) Seeds were treated with synthetic growth-promoting substances incorporated in talc or standard mercurial dust, and at appropriate concentrations both root and shoot growth was markedly stimulated. For cereal seeds half an ounce of dust was applied per bushel of seed. Some optimum treatments expressed as parts by weight of hormone per million parts by weight of seed were :—Wheat 2 p.p.m. indolylacetic acid gave 65%, 2 p.p.m. α-naphthalene acetic acid 102% and 2 p.p.m. indolebutyric acid 55% increase in length of roots over controls after 14 days growth. The shoot growth was also increased up to 20%. For barley and soya bean seed 2 p.p.m. and 10 p.p.m. respectively of α-naphthalene acetic acid gave optimum responses. Field trials based on these results are in progress. (*b*) Young tomato, nasturtium and salvia seedlings were watered daily with 50 c.c. of a nutrient solution containing phytohormones, and growth was greatly increased using concentrations of either indolylacetic acid or α-naphthalene acetic acid between 1/10 and 1/100 p.p.m. With decreasing concentrations the effect diminished, and increasing concentrations led to injury and death. The reaction was most marked in sand cultures, and less so in soil and the extent of the stimulation was greatest in very young plants. Lower plant forms also responded. (*c*) Dust treatment of cuttings proved very effective for stimulating rooting and the cuttings showed a wider range of tolerance than is usual with solution treatment. H.L.P.

340. BOAS, F., AND BAUER, R. 577.15.04
Ueber das Wuchsstoffbedürfnis von *Dematium*. (**The growth substance requirements of *Dematium*.**)
Protoplasma, 1936, **27** : 106-13, bibl. 8.

Results of experiments using *D. pullulans* as a test fungus show it to be a useful fungus for growth substance investigations despite its neglect for such use previously. Although its reactions to growth substances are not quite so great as those of yeast, it has the following great advantages over yeast :—(1) Its bud mycelium comprises 5-10 cells at most and hence gives less chance of error when making determination by the counting process*, and (2) the multiplicity of growth possibilities in *D. pullulans*, which is so useful for the recognition of division growth substances, is entirely lacking in yeast.

Photoperiodism†

341. TINCKER, M. A. H. 612.014.44
Photoperiodism and horticultural practice.
Sci. Hort., 1938, **6** : 133-49, bibl. 65.

The knowledge of the nature of photoperiodism accumulated as a result of investigations by workers in many countries is summarized in the first part of the paper. In the second part the application of photoperiodism to commercial practice is discussed. It plays its part for instance in the acclimatization of imported plants, in bulb formation in onions, in the bolting of lettuces, in the dormancy of strawberries, in plant breeding by the permitting of the synchronization of flowering periods to enable cross-fertilization of early and late varieties, in vegetative propagation, in acceleration of flowering and in crop forcing. An appendix gives lists of short day plants, of long day plants, of plants suitable and unsuitable for forcing by supplementary light, and of relatively indifferent plants.

* If one uses ammonium sulphate as a source of nitrogen, one can in suitable cases determine the pH value as a measure of growth promoting effect. This is dealt with in another article.

† See also 516, 545.

342. EGUCHI, T. 612.014.44 : 581.145.1
Effects of the relative length of day and night before and after bud differentiation on the formation and development of flower buds. Fifth report.
[Japanese, English summary 2 pp.]
J. hort. Ass. Japan, 1937, **8** : 203-34, bibl. 51.

In 1931-36 short-day plants, long-day plants and ever-flowering plants were studied at the Chiba Horticultural College. 16 kinds of plant were used in the experiments, each variety being divided into 2 groups, one of which received the photoperiodic treatments before flower bud differentiation had occurred and the other was first subjected to treatment after differentiation had taken place. The conclusions reached may be summed up as follows :—When the time of differentiation of flower bud was accepted as the basis of classification, there were found three photoperiodic types of plant (long-day, short-day and independent plants) and when the subsequent development of differentiated bud up to flowering was considered these 3 photoperiodic categories could still be maintained. Therefore, in classifying a plant as to its photoperiodic type both the effects of day-length on the time of differentiation of flower bud and the effects on the subsequent growth of differentiated bud up to flowering should be considered. Nine groups of plant are reported here, representing the possible combinations of photoperiodic responses of two stages, differentiation and further development, in the course of flower formation.

343. ASAMI, Y., AND ITO, H. 581.192 : 581.145
Studies on the chemical composition of plants associated with flower bud formation.
J. hort. Ass. Japan, 1937, **8** : 337-46, bibl. 7.

In 1935 and 1936 studies were made with short-day plants and Chojuro pear trees to find the relationship between chemical composition of the plants and flower bud formation. The following notes are taken from the summary. Carbohydrate ratios have not proved of special significance in flower bud formation. In the comparison of chemical composition between early summer headed shoots and late summer headed shoots and also between shoots of long growth and medium growth of the Chojuro pear a high content of soluble nitrogen was associated with flower bud formation. In cosmos and chrysanthemum (short-day plants) the content of carbohydrates was found to decrease under short-day conditions and flower bud formation in these plants was, therefore, associated with a decrease in carbohydrates, thus contradicting the general assumption that accumulation of carbohydrates favours flower bud production. Experimental data indicate that high content of nitrogen generally favours flower bud formation.

344. ROBERTS, R. H., AND STRUCKMEYER, B. E. 612.014.44 : 551.52
The effect of temperature upon the responses of plants to photoperiod.
Science, 1937, **85** : 290-1.

Experiments with a number of plants including chinese cabbage, chrysanthemum, geranium, hemp, lettuce, pansy, spinach, stock, *Rudbeckia* and poinsettia have shown that the customary responses of these plants to photoperiod are altered by changes in temperature. Thus poinsettias grown in short winter days at a temperature of 68-70° F. remained strongly vegetative and did not blossom, while plants in temperatures of 60-65° F. blossomed normally and plants in temperatures of 55-57° F. showed only slight tendency to blossom. Poinsettia plants, moreover, which were moved from 63°, after forming blossom buds, to 70° F., abscissed their flower clusters. A large percentage of the poinsettia plants grown in long days at temperatures of 55°-57° produced blossoms.

345. SHAFER, JR., J. 631.829 : 612.014.44
Effect of light on CO_2 of leaves.
Plant Physiol., 1938, **13** : 141-56, bibl. 8.

From certain data obtained by use of a method whereby the gases in a single leaf can be extracted and analysed for CO_2 it is concluded that leaves in light or dark contain much CO_2 and leaves in

the light more than those in the dark. CO_2 is not entirely or mainly in the intercellular spaces. This gas cannot be held simply in solution. Part of the CO_2 in lighted leaves is held by some light-activated mechanism which involves adsorption or loose chemical combination. Chlorophyll is not concerned with this light-activated mechanism. [From author's summary.]

Various

346. Nilov, V. I. 581.192
Chemical variability of plants. [Russian, English summary 1½ pp.]
Bull. appl. Bot. Leningr., 1936, Ser. III, No. **13**, pp. 5-29.
A study of the chemical variability in the ontogenetic evolution of plants, of the chemical variability in individual plants from the same clone, variation in various biotypes within a species and in various species within a genus, and also of variation during hybridization and in experimentally obtained mutations.

347. Lenin Academy of Agricultural Sciences. 631.67
Physiological estimation of the influence of irrigation on the plant. [Russian, English summaries.]
Bull. appl. Bot. Leningr., 1935, Ser. III, No. **12**, pp. 257.
In this bulletin numerous data are given by different authors of the influence of irrigation on the following crops :—cotton, wheat, alfalfa, melons and oil bearing plants.

348. Rehm, W. S. 631.547.2 : 635.652 : 541.135.6
Bud regeneration and electrical polarities in *Phaseolus multiflorus*.
Plant Physiol., 1938, **13** : 81-101, bibl. 27.
The paper is concerned with the relationship between bioelectric currents and bud inhibition. It is concluded that the response of the node potentials to the immediate effect of decapitation is probably not a causative factor in the regeneration of the buds. There is shown to be a definite correlation between the inhibited and regenerating buds and the bioelectric potentials. Experiments were made on the effect of applied currents and the interpretation of these is discussed.

349. Mackinney, G. 547.979.7
Some absorption spectra of leaf extracts.
Plant Physiol., 1938, **13** : 123-39.
It is concluded that the leaves studied (taken from widely different genera), when extracted by appropriate means, contain only two chlorophyll components, spectroscopically identical with similar components from different leaf sources. When, therefore, leaf extracts show differences in the absorption spectra which cannot be ascribed to method of leaf killing, it may be concluded there are differences in the ratio of the two chlorophyll components. Adsorption studies on inulin are definitely unfavourable to the hypothesis of a third component. [From author's summary.]

350. Wright, L. E. 631.811.9
The rôle of elements other than nitrogen, phosphorus and potassium in crop production.
Sci. Agr., 1937, **17** : 283-93, bibl. 12.
The general effect on crops of deficiencies of some of the minor elements (calcium, magnesium, sulphur, iron, manganese, copper, zinc, boron) is discussed for each mineral respectively. Special reference is made to certain experiments with these minerals on a few root crops at the experiment station, Kentville, Nova Scotia.

351. Schachtschabel, P. 631.416.4
Untersuchungen über das pflanzenaufnehmbare Kali. (**Investigations on available potash in soils.**)
Ernähr. Pfl., 1938, **34** : 129-32.
In this paper a description is given of quantitative studies made of the uptake of non-replaceable potash from different soils by rye seedlings which were grown in these soils several times in

succession under the conditions prescribed by Neubauer. The author concludes that, of the different potash minerals able to yield up their potash to the plant, mica forms the chief source of non-replaceable potash for the plant. Graphs and tables are given.

352. APSITS, J. 631.8 : 631.425
Handelsdünger und Bodenstruktur. (**Commercial fertilizers and soil structure.**)
Ernähr. Pfl., 1938, **34** : 109-14.
In 1936 and 1937 experiments were carried out at the experiment station of the Agricultural Faculty of the University of Latvia, Vecause, in order to find how far commercial fertilizers affect the structure of soils. Field trials were made on soils of uniform structure (sandy soil with a low fraction of clay). Different fertilizers were tried. In some cases they were broadcast on the surface of the soil, in others they were thoroughly mixed with the soil. To some plots no fertilizers were applied, but otherwise the plots received the same treatment as the others. None of the fertilizers used was found to have an appreciable effect on the structure, aeration or moisture content of the soil.

353. MUTH, F., AND BIRK, H. 631.8
Versuche über die wachstumsfördernde Wirkung der Rohbraunkohle, der Kohle-dünger Amoko und Wasko sowie des Schwefels. (**Investigations into the stimulating effect of crude lignite, the carbon fertilizers Amoko and Wasko and of sulphur.**)
Gartenbauwiss., 1938, **11** : 523-36, bibl. ½ p.
The results of trials carried on for several years by the Geisenheim Horticultural Research Station into the fertilizing effect in field and glasshouse of crude lignite, and the carbon fertilizers derived from it, namely Amoko and Wasko, and of sulphur are here described and discussed in considerable detail. The authors conclude that the growth stimulation induced by all of them is chiefly attributable to their nitrogen content. The experimental results give no indication of humic acid or hormone effect.

354. BRESCHKE, K. 631.346
Vergleichende Untersuchungen an Tontöpfen in physikalischer, chemischer und physiologischer Hinsicht. (**Comparative trials with ordinary garden pots judged from a physical, chemical and physiological standpoint.**)
Gartenbauwiss., 1938, **11** : 335-90, bibl. 29.
A dissertation of the Agricultural College in Berlin. Physical, chemical and physiological tests were made with ordinary clay flower pots which were obtained from 5 different places in Germany. Investigations were made into porosity, permeability of water and air, into chemical influences and the effect of these factors on the yield of the plant. The experiments are discussed at length and results are summarized. Considerable variation was found in pots of different origin.

355. SCHARRER, K., AND SCHROPP, W. 631.811.1 : 551.571
Über den Stickstoffgehalt der Niederschläge. (**Nitrogen content in rainfall.**)
Forschungsdienst, 1938, **5** : 469-72, bibl. 4.
Determinations of N content in rainfall were made for a period of 8 years (1928-36) at the Agricultural Chemical Institute, Giessen, and at Weihenstephan. Graphs and tables are given. 0·2-3·9 mg. nitrogen was determined per litre rainfall, and 10·7-19·5 kg. yearly per ha. [=9·5-17·3 lb. per acre], the average content of nitrogen in rainfall for eight years being 14·8 kg. per ha. It was found that 58·76% of the total N fell during the summer and 41·24% during the winter rainfall.

TREE FRUITS, DECIDUOUS.

General.

356. ANON. 634.1/8(944)
Fruit research work.
Fruit World, Melbourne, 1937, **38** : 12 : 6.

A note is given of the nature of the research work now being carried on at the various research stations in New South Wales.

357. INSTITUTE OF PLANT INDUSTRY, LENINGRAD. 634.1/7
Fruits and small fruits and their wild relatives. [Russian.] (Being part 5 of The plant resources of the world as initial material in plant breeding.) 1934, pp. 128.

Fruit tree selection and methods of utilizing cultivated varieties and their wild relatives, by Rubtsov, G. A. and other, pp. 5-38. This article is introductory to those which follow. *The apple* by Likhonos, F. D. and others, pp. 39-58. The writers class apples into some 12 groups according to their origin in 8 different parts of the U.S.S.R., Southern Europe, Italy and America (2 groups). They consider the characteristics of each group and note that the chief task of breeding lies in the production of apples combining the fruit qualities of the foreign apples with the frost resistance of the Russian varieties. Experience at the Mitchurin research station indicates the possibility of this.

The pear, by Rubtsov, G. A., pp. 59-72. The author briefly describes native and introduced pear varieties. He considers that the behaviour and characteristics of the different pear varieties need further study before successful breeding work can be undertaken.

The plum, by Kryukov, F. A., pp. 73-6. In 1933 the Institute of Plant Industry, Leningrad, possessed over 300 plum varieties and, in addition, a much greater number of cherry plum seedlings were available in the Caucasus. The breeding of frost resistant varieties was started at the Krasnyi Pakhar experiment base in 1927, and in 1928 experiments on all varieties began at the North Caucasian Station and at other Sub-Stations of the Institute of Plant Industry. The author makes suggestions of varieties suitable for trial. It is too early as yet to draw any conclusions.

The apricot, by Kostina, K. F., pp. 77-89. A list is given of 48 important apricot types, the study of which was started at the Institute of Plant Industry in 1928. Lists of the best varieties and of varieties which are not self-fertile are given.

The strawberry, by Katinskaya, Yu. K., pp. 93-101. The studies which began in 1926 were carried out at the Leningrad experimental base near Slutsk. So far the collection under trial consists of 405 types, half of which have come from France, Germany and Italy, 28 from N. America and the remainder from Russia itself. Six years' study has allowed the selection of 40 types suitable for further selection work. These are listed.

The raspberry, by Bologovskaya, R. P., pp. 103-10. A report is made on a large number of cultivated and wild raspberry varieties indigenous to the U.S.S.R. and of some dozen varieties imported from America, England and elsewhere. Thirty-five are considered suitable for selection and breeding work in the U.S.S.R. The observations made indicate that susceptibility of raspberry varieties to fungi is less pronounced in the U.S.S.R. than in America.

The gooseberry and the black and white currants, by Pavlova, N. M., pp. 111-27. Gooseberry varieties have been under investigation at the Krasnyi Pakhar experimental base since 1926 where some 757 different varieties or hybrids were available, most of them coming from western Europe.

In summing up the aims of the small fruit breeder and selectionist in the U.S.S.R. the necessity is noted for the production of berry fruits resistant to frost and drought.

358. Hu, C. C. 634.13
The variety and distribution of pears in China. [Japanese, English summary 9 pp.]
J. hort. Ass. Japan, 1937, **8** : 235-51, bibl. 22.
Cultivated pears in China belong to the following species :—Tsiu Tzu Li (*Pyrus ussuriensis* Maximowicz), Pei Li (*Pyrus Breitschneideri* Rehder) and Sha Li (*Pyrus serotina* Rehder). The first group is adapted to cold, dry regions and is found in the provinces of Fengtein, Kirin and Hopei. The Pei Li group is less resistant to cold and drought than the Tsiu Tzu Li group. Pei Li varieties are mainly distributed throughout the provinces of Honan, Hopei and Shantung. The last group, Sha Li, is adapted to mild and wet regions and is mainly found along the rivers Yangtze and Chukiang. A key for determining the Chinese cultivated pear varieties is given and wild pear species used as rootstocks are named. These are *P. betulaefolia* Bunge, *P. Calleryana* Decaisne, *P. serrulata* Rehder, *P. phaeocarpa* Rehder, *P. serotina* Rehder, and *P. ussuriensis* Maximowicz.

359. Aubert, P. 634.11
Quelques variétés de pommes nouvelles ou peu connues. (**New or little known apple varieties.**)
Reprinted from *Annu. agric. Suisse 1938*, 21 pp.
An account is given of a large number of local or foreign apple varieties which have been on trial in the grounds of the Swiss Federal Research Station at Pully during the last ten years. Results indicate that most of the local varieties are not worthy of extension beyond their present limits. A number of foreign varieties are also named which are found under Swiss conditions to produce poor quality fruit, to be difficult to cultivate and to be very susceptible to disease. Foreign varieties suited to Swiss conditions and worthy of consideration for further study and possibly growing commercially are :—Golden Noble, Granny Smith, Red Gravenstein, Jonathan, London Pippin, Statesman, Winter Banana, and Worcester Pearmain.

*Breeding.**

360. Sansome, F. W. 576.312.3 : 634/5
Chromosomes and their importance in horticulture.
Sci. Hort., 1938, **6** : 199-214, bibl. 9.
The article summarizes in simple terms the behaviour of chromosomes in so far as it affects genetics and plant breeding.

361. Lawrence, W. J. C. 631.523 : 634/5
Plant improvement : the application of genetics to horticulture.
Sci. Hort., 1938, **6** : 117-23, bibl. 5.
This is a survey of the plant breeder's work and problems in somewhat general terms, in the course of which the following points are made :—(1) Plant improvement in the past has been haphazard and wasteful, (2) the commercial plant breeder too often has but little idea of the ways in which a knowledge of genetics could help him, (3) there should be a closer liaison between plant breeder and geneticist.

362. Scott-Moncrieff, R. 581.175.11 : 575.1
The nature and inheritance of flower colour.
Sci. Hort., 1938, **6** : 124-32.
The nature and rôle of flower pigments are described and the way in which the knowledge available can be applied to plant breeding is discussed. The results accruing from the study of colour varieties at the John Innes Horticultural Institution during recent years are summarized.

* See also 322.

363. Rubtsov, G. A. 634.1/8-1.523
Scientific basis of fruit tree breeding. [Russian.]
Supplement to Bull. appl. Bot., Leningr., **78**, 1936, pp. 124, bibl. 9 pp.
After a historical and botanical geographical introduction, followed by notes on variation of fruit trees, the genetic basis of fruit tree breeding is discussed under the following heads :— Hybridization ; the rôle of the chromosomal apparatus and the significance of cytology ; sterility and constancy of distant hybrids ; genetic structure of fruit trees ; choice of parents ; inbreeding ; mutations ; permanent modifications ; environmental influence ; xenia, parthenocarpy and apogamy. Further, specific peculiarities, chief tendencies and methods of fruit breeding are described, and the principles of selection, raising seedlings and organization of breeding pome fruits, stone fruits and nuts are discussed, notes on crosses and hybrids being given. A useful bibliography includes a number of recent Russian articles and other works.

364. Teterev, F. 634.11
Apple varieties in Ukraine. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 4, p. 60.
A brief note is given of the apple breeding work which has now been in progress for some years at the Mleev Agricultural Experiment Station in the Ukraine. The aim here is apparently the production of better quality commercial varieties. Seedlings now number 100,000 and it is noted that some 14,000 should bear fruit in 1938. Certain particularly promising hybrids have already been noted.

365. Leonov, I. M. 581.13 : 634.11
Selection work with apples in Siberia. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 4, pp. 50-4.
Hardiness in Siberian apple trees has been studied for many years at Minusinsk. The study has included investigations into relationships between phenophases and size of fruit, between leaf pubescence and hardiness and between degree of pubescence and size of fruit. The author summarizes the conclusions reached as follows :—1. The earlier in the season a variety starts into growth, the hardier it is. This is valid for any combination of climatic conditions. 2. The more delayed the actual beginning of the growth period of a variety is from the time of possible initiation of growth for a locality, the less hardy is the variety. 3. An early termination of the growth period does not necessarily indicate that the variety is hardy. 4. The density of leaf pubescence is a character determining the frost resistance and the size of fruit of a variety. The denser the pubescence, the later is the beginning of growth period and the less hardy is the variety, and the larger is the size of fruit. 5. Varieties with leaves without pubescence initiate growth early, and are hardy, but bear small fruits. 6. The time of the beginning of the growth period is a character determining the size of fruit. Varieties initiating growth early produce small fruits, whereas varieties with a late beginning of the growth period produce large-sized fruits. 7. One year's careful study is sufficient for determining hardiness of a variety by this method. The age of the trees is said to have very little effect on phenophases of a variety. 8. This method of determining hardiness and size of fruit may be employed with equally good effect to seedlings and to grafted varieties. 9. Some deviations from the above were found and are discussed.

*Propagation.**

366. Ure, C. R. 631.535.4 : 635.976/7
Preliminary tests with softwood cuttings of trees and shrubs in Alberta.
Sci. Agric., 1937, **17** : 720-6.
Satisfactory results have been obtained in Alberta in rooting a number of trees and shrubs (of which a list is given) from softwood cuttings in frames, in a greenhouse. As a rule a higher percentage of rooting was obtained in the sand or sand-peat medium than in peat alone. If

* See also 317-340, 382, 615.

there is any preference between the first two it is in favour of sand. Bottom heat proved beneficial, a safe guide being to have the temperature of the frames 5°-10° F. higher than the outside atmosphere (the trials were made in July). A temperature of 60°-70° F. proved definitely the most satisfactory. A table is given showing the best place to make the basal cut and the most suitable time for doing so in the case of some 19 varieties. The stage of maturity at which the cutting should be taken is important. Most success was obtained with fairly mature green shoots rather than from the rapidly growing part.

367. UPSHALL, W. H. 631.535.6 : 634.11 + 634.22
Propagation response from root-cuttings planted with the proximal end projecting above the medium.
Sci. Agric., 1936, **17** : 146-7, bibl. 3.

In experiments over a period of 3 years in Canada root cuttings of plums and apples set in a sand-peat medium under glass with the proximal ends projecting 0·6 cm.-2·5 cm. above the surface gave a much better rooting response than cuttings set just under the surface in the usual way. Top growth was also more rapid and of those which failed the projecting ones rotted less rapidly than the submerged.

368. KERR, W. L. 631.541.5 : 634.1/7
Early spring budding by the plate method.
Sci. Agric., 1937, **17** : 713-9, bibl. 7.

A budding method is described which has given very successful results with fruit trees in U.S.A. It has the advantage that it is not necessary to wait for the bark to slip before it can be used, as is the case with other budding methods. The name given to it here is plate budding or the Jones method, being credited to J. F. Jones of Pennsylvania. [It is difficult to see from the details supplied how this method differs from that long known in England as chip budding. —ED.]

369. MASOT, J. 631.535
Pour assurer une meilleure reprise des boutures. (**Method of obtaining a higher percentage of rooting with cuttings.**)
Rev. hort. Afr. N., 1938, **42** : 90-1.

Hardwood cuttings of most subjects will give a higher percentage of rooting if they are first buried head downwards in sand. When they are lifted and set in the normal way they root very quickly, having meanwhile callused freely, before the top growth has time to start. It is not stated for how long the cuttings should remain inverted. It is claimed that the most refractory species will root without difficulty if so treated.

370. DUCOMET, V., AND SOUTZ, J. 634.25-1.535/41
Sur la multiplication végétative du pêcher. (**Vegetative propagation of the peach.**)
C. R. Acad. Agric. Fr., 1937, **23** : 539-43.

A note of successful trials of the propagation of peach varieties by layers and cuttings. The layering is similar to that employed commonly for the production of clonal plum stocks in England. Cuttings of about 20 cm. in length, kept horizontally during the winter in river sand, are planted out vertically under cloches in the spring. The rooted cuttings and layers are to be tried in the grounds of the Centre de Recherches Agronomiques du Sud-Ouest, where they will be tested against peaches grafted and budded in the usual way.

371. LA RUE, C. D. 546.14 : 631.531.17
The use of bromine in the sterilization of fruits and seeds.
Science, 1937, **85** : 319.

Bromine water diluted to 1/10 its normal strength is found an excellent sterilizer for seeds and fruits where sterile seedlings or embryos for cultivation are required. The solution is applied

in a stoppered bottle and the time of exposure must be determined for different plants. No rinsing is needed afterwards and the treated structures are at once transferred to their growing medium as required. The bromine soon disappears.

Rootstocks.

372. Kemmer, E. 631.541.11 : 634.2
Die Steinobstunterlagen. (**Rootstocks for stone fruit.**)
Merkbl. Inst. Obstbau, Berlin, **7**, 1938, pp. 16.

The author summarizes in this paper the facts known about rootstocks for the stone fruits with special reference to German conditions. Results of work in other countries, especially England, are noted. It is noted that of the rootstocks used up to the present time Ackersmann's Plum (or Marunke) has proved consistently the most reliable in Germany. This is said to be medium strong growing, very thorny, difficult to propagate by stooling but easier by layering. Its anchorage is good and it is frost resistant. It should be worked early, as shoot growth ceases early. In Germany plums are said always to take well on it and to grow healthily and crop well. It is also strongly recommended for peaches and apricots in Germany.

Among other stocks not so well known in England but said to be used or to offer promise in Germany are Hüttner's IV (? *P. domestica*), Wurzelechte Reneklode, and White Myrobalan (from the Palatinate). Details of growth, anchorage, etc., are given. A note of warning is uttered against judging the behaviour of worked stocks from that of the same stocks unworked. Thus early flowering myrobalan is found to induce late flowering in scions and late flowering pershore to induce early flowering in scions. Seedling plum stocks appear to be at least as mixed in Germany as elsewhere, but the few German data available suggest that the variations in clonally raised stocks are sometimes as great as those in seedlings. Further work on the point seems necessary.

373. Truet, H. 634.21-1.541.11
Contribution à l'étude des divers portegreffes des arbres fruitiers en Algérie. (**Rootstocks for fruit trees in Algiers.**)
Rev. hort. Afr. N., 1938, **42** : 80-4.

The apricot is grafted mainly on wild apricot, almond and peach. The seedling apricot is suitable for deep rich and moist but well-drained or permeable soils. It is drought resistant and long-lived and takes a firm hold of the ground. The (so-called) wild apricot (mish-mish) is a good stock for varieties of moderate vigour or in dry or saline soils. For good soils or for strong growing scion varieties it is preferable to raise seed for stock from the better kinds of apricot. The mish-mish suits certain European apricots well, inducing seasonal precocity in vegetation. The apricot root can be distinguished from plum by the red colour of the tissues. If a transverse cut is made through the root the medullary rays will not be clearly visible; as in the peach the bark is thick.

The almond when used as a direct apricot stock prefers moist, that is irrigated, land. The union is never very good at the start and often continues fragile, being a frequent cause of breakages. If it survives the first years the union eventually becomes satisfactory and in a suitable soil produces a long-lived tree. When, however, a peach intermediate is used, the union is at once good and the almond root produces successful trees even on hot, dry and rocky land and on the deep and penetrable shale of the hill sides. On almond the apricot comes early into first bearing. Certain varieties of apricot are less compatible with almond than are others, so that with these peach must be used as an intermediary. The almond root has a thinner bark than the peach, is less smooth and carries transverse groups of linear lenticels. A fresh transverse cut shows the medullary rays very clearly.

The peach is a suitable stock in moist light soils. It comes into first bearing quickly but is short-lived. It is useful when the apricots are used as fillers pending the full establishment of the main crop. The peach root is to be distinguished by its thick, smooth bark and by small groups of irregularly placed lenticels and by the slightly reddish tint of the epidermis. When cut across the medullary rays are only indistinctly seen.

Marianna plum is a good stock for apricot on hard, argilo-calcareous soils subject to high fluctuations of moisture and drought. It is recommended for sandy soil by reason of its easy reproduction from cuttings. On marianna the apricot is sometimes over-luxuriant and is liable to gumming.
Myrobolan plum is also used, stocks being best raised from cuttings. The myrobolan accepts dry and calcareous soils but is always at its best on moist, rather rich land. It has a good compatibility with the apricot, but produces over-luxuriant growth and a tendency to gum. On certain soils with an underlying hard-pan it will succeed where the apricot free stock would fail. Conversely in certain oases it is unsuitable, because its growth lags behind that of the scion. The brown root of the myrobolan is easily distinguished from apricot, almond and peach. The bark of both large and medium roots is smooth and anatomical examination will show marked differences between the four.
St. Julien plum is a common stock for the apricot in France, though incompatible with some. Its ability to produce a robust habit in the scions makes it a favourite with nurserymen. Especially on irrigated lands it suckers freely to its own detriment. It transplants badly in Algiers and on the whole is a stock to avoid, particularly since myrobolan does well on lands suited to St. Julien. The root is reddish. The large and medium roots are irregularly knobbed.

374. Gorshkov, I. S. 631.541.11 : 634.1/2
The choice of rootstocks. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 4, pp. 45-6.
The author gives his views on rootstocks available in the central regions of U.S.S.R. He considers the Tayezhnoe apple variety as one of the best stocks. Tayezhnoe is a hybrid obtained by Mitchurin from the cross Candil-Kitaika and Sibirka. This rootstock may be propagated from stools or cuttings as well as from seeds, the variation of individual seedlings being only very slight. The take on a Tayezhnoe stock is said to be very satisfactory, and the stock itself to be absolutely hardy. *Cerasus Padus* forms bred by Mitchurin, combining hardiness with drought resistance, are thought to be valuable as rootstocks for cherries. As a rootstock for stone fruits, and particularly, for sweet and sour cherries, *Prunus Maakki*, is recommended. It is absolutely hardy, not liable to gum-flow, disease resistant and it forms good unions. *Prunus pumila* and *P. Besseyi* may be considered as good rootstocks for plums and apricots.

Pollination.

375. Kühlwein, H. 634.22 : 581.162.3
Untersuchungen über die Befruchtungsverhältnisse beim Steinobst. (**Fertility trials with stone fruit trees.**)
Gartenbauwiss., 1938, **11** : 614-20, bibl. 3.
It was observed in the Lützelsachser Frühzwetsche plum that despite ample flower production little or no fruit is often formed. As a result both field and laboratory trials were made with this plum by the Institute of Applied Botany of the University of Würzburg. The material used in the experiment was obtained from an orchard at Kleinwallstadt in Obernburg, and consisted of approximately 3,000 trees. The data are tabulated. Among conclusions reached are the following :—Lützelsachser Frühzwetsche was found to respond best to pollen of the varieties Tragedy and Ersinger Frühzwetsche. No difference was observed as regards fertility between Lützelsachser Frühzwetsche on myrobalan stocks and on St. Julien stocks. One further isolated but interesting observation was that, where mustard was used as a cover crop either for ploughing in or for feeding the stock, apple trees in bloom standing amidst mustard in flower were scarcely at all visited by bees, despite great activity of the bees below among the mustard. This observation is considered to warrant further investigation.

376. Dickson, G. H. 634.22 : 581.162.3
Pollination of the Shiro plum.
Sci. Agric., 1937, **17** : 727-9.
Under orchard conditions in Canada the Japanese plum Shiro is not cross-pollinated by Burbank when growing in proximity to it, but when hand-pollinated with Burbank it sets well.

Explanations are not offered. Two *domestica* varieties, Reine Claude and Lombard, are good pollinators for Shiro, but the formation of viable seeds from these crosses is rare.

377. Jahn, A. 634.25 : 581.162.3
Weiterer Beitrag zur Frage der Sortenbeschreibung und der Fertilitätsverhältnisse beim Pfirsich. II. (Blütenbilder.) (**Differentiation of varieties and fertility in the peach. II. (Description of flowers.)**)
Gartenbauwiss., 1938, **11** : 573-96, bibl. 5.
Branscheidt's investigations into differentiation of varieties and fertility in the peach during 1931, 1932 and 1933 were described in *Gartenbauwiss.*, 1933, 8 : 45-76 (*H.A.*, 3 : 467). In the studies carried on in 1935, 1936 and 1937 pollen germination trials were made as well as cross pollination trials on F_2 seedlings of the variety Blum Seedling II, and certain conclusions on genetic relationships of the so-called " steinecht "* varieties are said to have been reached. The report contains numerous illustrations and tabulated data.

378. Crane, M. B. 634.23 : 581.162.3
The formation and development of cherries.
Sci. Hort., 1938, **6** : 223-8, bibl. 3.
Aspects of the author's experiments with cherries at the John Innes Horticultural Institution which are of practical interest are explained and tables are given showing groups of co-incompatible sweet cherries, fruit set of sour and duke cherries following self-pollination, cherry varieties in order and time of full bloom, and a summary of effective cross-pollinations between cherry varieties. A detailed account of these experiments has already been published. (*J. Pomol.*, 1937, 15 : 86-116, *H.A.*, 7 : 564.)

379. Schribaux, E., and Fleckinger, J. 581.162.3/5 : 634.11 + 634.13
La stérilité chez le pommier et le poirier. (**Sterility in the apple and pear.**)
C.R. Acad. Agric. Fr., 1937, **23** : 431-40.
The results of Fleckinger's pollen germination studies on some 160 apple and 52 pear varieties are here tabulated. The germination in sugar solution varied from 0-30% to 90-100%. Notes are made of those varieties known to be triploid or diploid. It is noticeable that nearly all the triploids are found in the 0-30% germination groups.

Growth and nutrition.†

380. Barnard, C. 634.1/7 : 581.145
Studies of growth and fruit bud formation. VI. A summary of observations during the seasons 1930/31 to 1934/35.
J. Coun. sci. industr. Res. Aust., 1938, **11** : 61-70, bibl. 8.
Determination of the time of fruit bud formation of a number of pome and stone fruits has been made for Victoria, South Australia, Western Australia and Tasmania. The author has done much previous work on the subject and information treating separately of various kinds of fruit has been already published in a number of papers contributed either to the journal from which this abstract is made or to the *Journal of the Department of Agriculture, Victoria.* In apples the fruit buds are formed during late December and early January and in stone fruits somewhat later. Variation in the time of differentiation from season to season in any one variety appears to be caused largely by the amount of fruit carried by the tree. Heavy crops induce early differentiation. Climatic conditions are of less importance, though weather unfavourable for vegetative growth may induce early fruit bud formation. The rate of bud development after differentiation is much the same for any one variety throughout the season. Retarding influences are drought or the presence of a heavy crop.

* i.e. varieties thought to breed true, but which cannot be considered as pure lines.

† See also 342, 343.

381. Asami, Y., and Ito, H. 581.192 : 581.145.1
Studies on the chemical composition of plants associated with flower bud formation.
J. hort. Ass. Japan, 1937, **8** : 337-46, bibl. 7.

From data obtained from Japanese pear and the short-day plants, cosmos and chrysanthemum, it is argued that the C/N ratios have not proved of special significance in flower bud formation and that a high content of soluble nitrogen has usually proved of significance. In fact in short-day plants flower bud formation was associated with a decrease in carbohydrate formation. [See abstract 511 (Grainger) this number.—Ed.]

382. Stoutemyer, V. T. 634.11 : 581.144.3 : 631.535
Regeneration in various types of apple wood.
Res. Bull. Ia agric. Exp. Sta. **220**, 1937, pp. 308-52, bibl. 57.

Trials of rooting of various types of apple cuttings were started in 1931 and were continued throughout 1936. The plant material was obtained from the orchards and nurseries of the Pomology Subsection of the Iowa Agricultural Experiment Station. The results of the investigations are summarized as follows :—Two distinct growth phases were shown to exist in apple trees. These phases were closely related to the ease of regeneration of roots on stems. Stem cuttings of mature wood were difficult to root without special treatments, while those made from shoots in the juvenile phase rooted very readily. The juvenile condition was recognized by the thinness of the leaves and small amount of pubescence. Anthocyanin production was abundant in juvenile shoots. In some apple species the shape of the leaf changed with maturity from an entire to a lobed form. Shoots having the juvenile characteristics of young apple seedlings were produced from roots of older trees. Stem cuttings made from such shoots usually formed roots readily. Juvenile shoots were produced from adventitious buds on roots and possibly from adventitious buds on limbs of mature trees. Water-sprouts were found to originate from latent buds rather than from adventitious buds. The only adventitious buds produced on stems were found on sphaeroplasts. Adventitious buds were produced readily on roots when the latter were placed under favourable temperature and moisture conditions. These buds arose from parenchyma in the secondary cortex and thus had no connexion with the cambium of the root. The transition from juvenile to mature form was not found to be related to the beginning of secondary growth in the plant, to the loss of primary structures, or to the stage of organization of the internal tissues of the stem. The expression of growth phases as well as the accompanying changes in case of root formation is believed to be dependent on certain biochemical factors which are not clearly understood at present.

383. Wilcox, J. C. 634.11 : 581.14 : 631.55
Field studies of apple tree growth and fruiting. III.* Some observations on the measurement of tree vigour.
Sci. Agric., 1937, **17** : 657-67, bibl. 44.

Field measurements for recording tree vigour are discussed. These are increase in trunk circumference, in cross-sectional area of trunk, terminal length, terminal diameter and spur growth. At least two of these should be used in conjunction for reliability. In field routine work the most suitable measurements are trunk circumference and terminal length for each year. Records of leaf area are useful. Terminal diameter of shoot should be taken close to the tip. A measure of vigour that has been found satisfactory is the growth index obtained by multiplying the annual increase in trunk circumference by the average terminal length. It should be noted that if the trees are biennial bearers, have suffered wide variations in pruning severity or of fertilizer treatments, the increase of area in cross-section or trunk circumference will be influenced.

* I. Sampling and measuring terminal fruits, and II. Correlations between growth and fruiting. *Ibidem*, **17** : 563-72 and 573-86, *H.A.*, 7 : 565.

384. Bell, H. P. 634.11 : 581.47
The origin of russeting in the Golden Russet apple.
Canad. J. Res., 1937, **15**, Sec. C., pp. 560-6, bibl. 7.
The author's studies confirm Zschokke's* finding that normal russeting in the apple originates in the epidermis. The author describes the process as follows :—" About the time of full bloom, many epidermal cells divide by a tangential wall. Later in June all the epidermal cells become vacuolated and some divide again by tangential walls, forming a layer varying from 2 to 4 cells thick. Early in July a cambium is initiated in the innermost cells of epidermal origin. This cambium is very active and immediately gives off cells which differentiate into cork. Non-russeted portions may have either a very thick convoluted cuticle or a double layer of cuticle. The development of the periderm and the histology of the mature protective layers are illustrated by 15 figures."

385. Bell, H. P. 634.11 : 581.47
The protective layers of the apple.
Canad. J. Res., 1937, **15**, Sec. C., pp. 391-402, bibl. 5.
The development of the four protective layers of a McIntosh Red apple fruit, namely hairs, cuticle, epidermis and hypodermis, is here traced in detail from the time when the flower emerges from the winter bud until harvest time. The make-up of these different parts and the condition of the cells forming them at six different dates are carefully described.

386. Grebensky, S. O. 634.22 : 581.192
Biochemical investigations of plums. [Russian, English summary 1 p.]
Bull. appl. Bot. Leningr., 1936, Ser. III, No. **15**, pp. 31-54, bibl. 13.
Biochemical analyses were made of the different varieties belonging to the subgenus *Euprunus* at the Sochi Fruit Research Station, as a result of which a number of biochemical differences were found between the different species and groups of varieties. The following notes are taken from the summary :—Sloes and some myrobalans were found to differ from other plums in that they show either complete absence or only a small content of sucrose and also have greater acidity and lower total sugar content. Within the *P. domestica* species the groups of varieties purple plums, Lombard plums and yellow egg plums differed from prunes by the predominance of sucrose over monosaccharides, while in prunes a reverse relation was found. This character was found to be slightly dependent on geographical conditions. The group of greengages was distinguishable by the high oil content of the seeds, while sloe and *Euprunus* seeds contained the lowest oil percentage. The biochemical differences between varieties and strains were also shown in the accumulation of monosaccharides and sucrose in the ripening fruits. Analyses showed that the sugar prevailing at the early stage of development was glucose, and that this was succeeded by accumulation of fructose, while towards the termination of ripening the amount of sucrose rapidly increased. The accumulation of sucrose was found to be associated with a marked decrease in acidity, particularly in that of the juice of fruits. A steady increase in oil was observed in ripening seeds and a decrease of the percentage of nitrogenous substances. Amygdalin was found to accumulate as the fruit ripens. The activity of vitamin C in some plum varieties was found equal to that in apples and potatoes. It was found to decrease as the fruit ripens. Data indicate that the varieties Spanish, Grand Duke, and Engelberg do not belong to the group of prunes. Early varieties with a high sugar content have been discovered. These were Finikovaya and Klieman. Since plums vary so greatly as regards their sugar, oil and acidity contents, they offer scope to anyone breeding for chemical composition.

* Über den Bau der Haut und die Ursachen der verschiedenen Haltbarkeit unserer Kernobstfrüchte. *Landw. Jrb. Schweiz*, 1897, **11** : 153-97.

387. Chandler, W. H., Kimball, M. H., Philp, G. L., Tufts, W. P., and Weldon, G. P. 581.144/5 : 634.1/7 : 551.56

Chilling requirements for opening of buds on deciduous orchard trees and some other plants in California.

Bull. Calif. agric. Exp. Sta. **611**, 1937, pp. 63, bibl. 25.

During the period 1924 to 1937 the effect of varying amounts of winter chilling on blossoming and the beginning of growth in deciduous plants in different parts of California was studied. The following conclusions are drawn from these studies :—In nearly all parts of California, where fruit is grown extensively, the amount of winter chilling is too small for buds to open as quickly and as evenly early in the spring as they would in regions with longer and colder winters. But except for a few areas near the coast, this delay is seldom injurious north of the Tehachapi mountains. On the contrary, it has a beneficial effect, since delay in bud break tends to reduce the frost hazard. In some parts south of Tehachapi the effects of the warmest winters are very injurious. Fruit buds and leaf buds that should open in March may not open until May or June, and then only a small percentage may open. Most of the flowers may fail to set fruit. Shoot growth and leaf growth on the tree may be so sparse that much injury arises from summer sunscald and borers. It was found that one of the most injurious results of very warm winters, on species that have only flower parts in the fruit buds, is the shedding of unswollen fruit buds in late winter and early spring. On apricots, and on some varieties of peaches and plums, shedding of the buds was observed during or after especially warm winters. This was even the case in northern California. On species having both flowers and leaves in the bud some of the flowers may die. The amount of fog is important in determining the effectiveness of winter chilling. In districts with much fog in winter, trees are less apt to shed their buds unopen or to be excessively delayed in opening of buds in spring. Winter shade is also beneficial. Great divergencies exist among deciduous species as regards the amount of chilling required to ensure satisfactory opening of the buds in spring. The characteristic responses to short winters of some deciduous fruit species and of some ornamentals are discussed.

388. Tukey, H. B. 581.145.2 : 634.23 + 634.25

Development of cherry and peach fruits as affected by destruction of the embryo.

Bot. Gaz., 1936, **98** : 1-24, bibl. 19.

Destruction of the embryo of sour cherry and peach early in the period of retarded increase of the pericarp (here called stage II), about mid-season, resulted in an abrupt check to fruit development, in shrivelling and in abscission. Destruction of the embryo in the second rapid increase of the pericarp to maturity (stage III) resulted in increased growth and earlier ripening and sometimes increase in size over untreated fruits. Similar destruction in the transition stage between II and III produced earlier ripening and failure to reach full size. Injuries to the fruit or seed, which did not affect the embryo, did not alter the growth rate of the fruit. The shorter the interval between the destruction of the embryo and the normal ripening date for the variety, the greater was the increase in growth rate of the pericarp. Two of the factors involved in the relation between embryo and pericarp appear to be (*a*) the stage of development of fruit and embryo at which the latter is destroyed, (*b*) the genetic make-up of the variety controlling this relation. Development of the embryo is shown to bear a definite relation to the development of the fruit quite distinct from the effect of fruit and seed formation upon the entire plant. In early ripening cherries and peaches it is the abortion of the embryo which effects pericarp development rather than the reverse. The effect of some adverse environmental conditions on development both of the embryo and of the fruit are discussed.

389. Tukey, H. B., and Lee, F. A. 581.145.2 : 634.25

Embryo abortion in the peach in relation to chemical composition and season of fruit ripening.

Bot. Gaz., 1937, **98** : 586-97, bibl. 15.

Embryos of ten varieties of peach, whose seasons of ripening covered all stages from early to late, were examined and chemically analysed at or near the time of maturity. The embryos of the

earliest ripening variety were abortive and disintegrated at fruit ripening. There was an increase in size and firmness of the embryos with the successive lateness of the varieties. Embryos of early ripening varieties at maturity showed a higher moisture content and a lower content of fat, nitrogen, reducing sugars and sucrose. The steady increase in growth, loss of moisture and accumulation of storage material in the embryos of all varieties was abruptly checked as the ripening date was reached. The close similarity observed in the growth of embryos of different varieties regardless of time of fruit ripening extends also to chemical changes within the developing embryos.

390. Tukey, H. B. 581.145.2 : 634.1/2
Growth patterns of plants developed from immature embryos in artificial culture.
Bot. Gaz., 1938, **99** : 630-65, bibl. 32.

Methods and results are given of the culture of embryos of a number of stone fruits, apples and pears. Embryos in culture do not pass through the series of embryonic stages characteristic of embryos on the mother plant, but enter at once into an independent development characteristic of the age of the embryo when excised. The growth pattern for the embryo of peach grown in nutrient agar with the addition of brewer's yeast after disinfection is recounted in detail, and minor differences to be found in other fruits under similar treatment are noted. Growth patterns were modified by altering the media, especially glucose, which at early stages was beneficial and at later stages inhibiting. The data are discussed with reference to physiological changes in the embryo, juvenile and adult forms of plants, and general problems of morphogenesis.

Soils.

391. Veihmeyer, F. J., and Hendrickson, A. H. 631.432 : 634.1/7 : 581.144.2
Soil moisture as an indication of root distribution in deciduous orchards.
Plant Physiol., 1938, **13** : 169-77.

The loss of moisture from the soil below the depth that dries in consequence of surface evaporation is due almost entirely to the use of water by the tree, and thus the drying of the soil during the growing season may be used as an indication of the spread and depth of the root system, provided the soil is fairly homogeneous and the root distribution is uniform. The data show where, with respect to the trunk of the tree, the soil samples should be taken, and the depth of sampling necessary to secure an adequate record of the use of water by the tree. The work discussed was carried out at Davis, California.

Manuring and cultural practice.*

392. Muskett, A. E., Horne, A. S., and Colhoun, J. 634.11-1.8
The effect of manuring upon apple fruits.
Ann. appl. Biol., 1938, **25** : 50-67, bibl. 12.

The influence of nitrogen in manurial treatments of apple trees is to increase growth, advance the time of flowering, increase the bloom, and produce greener foliage and softer and greener fruit. Potash and phosphate have little effect on growth but tend to produce highly coloured fruit. Figures are given showing the increased nitrogen content in fruit from an Irish orchard which received nitrogen over the controls which received none. Radial advance of the fungus *Cytosporina ludibunda* was positively correlated with the nitrogen content of the fruit and nitrogenous manuring was also found to increase the intensity of attack by *Venturia inaequalis*. Evidence is produced to show that fruit resistant to *Venturia inaequalis* may also be resistant to a rot-producing fungus in store.

393. Collison, R. C. 634.1/2-1.83+1.84
Potash and phosphorus in relation to organic matter in New York orchards.
Bull. N.Y. St. agric. Exp. Sta. **679**, 1937, pp. 18.

Experiments with fertilizers were carried on at the New York State Agricultural Experiment Station for a period of some ten years. The results can be summed up as follows :—No yield

* See also 350-355.

response was observed in the field experiments to any fertilizer element under a system of clean cultivation. The experiments under sod or partial sod conditions showed significant response to nitrogen. For several standard varieties and for a variety of soil types no response was recorded to either potash or phosphorus. The reasons for this lack of response are discussed, and the importance of potash, particularly in orchards on light soil, is indicated. Data are given which show that phosphorus equivalent to over 100 lb. of superphosphate and potash equivalent to 200 lb. of muriate of potash may be made available each year through the growth and decomposition of a cover crop. Some differences between static and dynamic organic matter in soils are shown and their relation to yields discussed.

394. Proebsting, E. L. 631.8 : 634.1/7
Fertilizing deciduous fruit trees in California.
Bull. Calif. agric. Exp. Sta. **610**, 1937, pp. 29, bibl. 4.
Over a period of some ten years studies have been made on peaches, prunes, pears, apricots and almonds by the Division of Pomology, University of California. Other tests were made by the Extension Division and some observations of field experiments were made elsewhere. The results of the studies may be summed up as follows :—Deciduous fruit trees were not found to respond profitably to potassium or phosphate in California. Response to nitrogen, though common, was not always obtained. The source of nitrogen appeared to be of little significance, except with materials that may be toxic under certain conditions. The decisive factor in the choice of nitrogenous fertilizers is said to be the unit price of nitrogen. Individual plot tests on each orchard are said to be the most satisfactory means of determining nitrogen deficiency and the degree of nitrogen deficiency in the soil. Further, the author states that the omission of important cultural practices such as pruning, irrigation, etc., cannot be made good by manuring.

395. Chandler, W. H. 634.1/2-1.811.9
Zinc as a nutrient for plants.*
Bot. Gaz., 1937, **98** : 625-46, bibl. 56.
The part played by zinc in plant nutrition is discussed. The annual amount of zinc required by an orchard tree is at the rate of 1 oz. per acre. The tree's inability sometimes to obtain even this small amount may not always be due to a deficiency of zinc in the soil or to a reaction unfavourable to the solution of zinc. Theories are put forward to explain the suggestion that the competition of soil flora may be involved, since some soils showing zinc deficiency will supply sufficient zinc for plant needs after sterilization.

396. Greenhill, A. W. 546.27 : 634/5-2.19
Boron deficiency in horticultural crops : recent developments.
Sci. Hort., 1938, **6** : 191-8, bibl. 15.
A short summary is given, with special reference to horticultural crops, of recent developments in the application of this element. *Heart rot of beets*, characterized by the blackening and death of the youngest or heart leaves, in the middle of the growing season, is prevented in practice by the application of 20 lb. of borax per acre when preparing the land for sowing. *Brown heart of turnips* is characterized by a brownish or greyish mottling of the flesh of the root either in small patches or extensively in mid-season. There are no external symptoms. Control is effected by the application of 10-20 lb. of borax per acre shortly before sowing. Spraying borax on to the soil or foliage has also proved beneficial. *Browning of cauliflower.* The stem and centre of the curd become discoloured and the affected head is bitter in flavour whether cooked or raw. A dressing of 10 lb. of borax per acre broadcast with the fertilizer prevents the disease. A dressing of 18 lb. of borax per acre, applied in solution or solid, when browning first appeared checked any further development. *Cracked stem and heart rot of celery*, a common disease in parts of U.S.A. and Canada is prevented by applying 10 lb. of borax per acre close to the plants 2 weeks after planting out or by spraying borax solution on to the soil. *Apples.* Internal cork,

* See also 532, 534.

corky core and drought spot of apples are all boron deficiency diseases. The rates of application vary with the different countries and the age of the tree, ranging from ½ to 4½ lb. of borax or the equivalent of boric acid per tree. Other horticultural crops in which boron deficiency has been definitely found to cause trouble are hops in Czechoslovakia, citrus in S. Rhodesia (hard fruit), cherry and apricot (drought spot) and prune and plum (gum spot) in British Columbia. In the majority of the remaining small fruit and vegetable crops the presence of boron is considered essential without any definite condition due to deficiency having yet been established. Boron may be present in the soil but unavailable to the plant. An excessive or uneven application of boron may also cause damage and the amounts recommended here should not be exceeded nor should any be applied until the need has been demonstrated. In view of the small amounts required and the consequent difficulty of even distribution it is recommended that the borax should be applied in the fertilizer.

397. Woodbridge, C. G. 634.11-2.19 : 546.27
The boron content of apple tissues as related to drought spot and corky core.
Sci. Agric., 1937, **18** : 41-8, bibl. 23.
In studies carried out in British Columbia low boron concentrations in the tree tissues are correlated with high incidence of drought spot and corky core. In twigs from healthy trees the boron content did not usually fall below 14 p.p.m., whereas in those from severely affected trees it was generally below 10 p.p.m. A correlation between low concentrations of boron in the soil and incidence of the disease was not established.

398. Chittenden, E., and Thomson, R. H. K. 664.85.11-2.19 : 546.27
The effect of borax top-dressing on the storage quality of Jonathan apples.
N.Z.J. Sci. Tech., 1938, **19** : 541-6, bibl. 2.
Experiments in New Zealand are described in which internal breakdown was much increased in Jonathan apples stored at 38° F. for 6 months when the trees had been previously treated with borax at rates varying from ½ to 3 lb. per tree. It is concluded that on boron deficient soils ½ lb. of borax per tree is the maximum that can be used without prejudice to the keeping quality of the fruit.

399. Atkinson, J. D. 634.11-2.19 : 546.27
Length of time during which soil dressings with boron remain effective.
N.Z.J. Sci. Tech., 1937, **19** : 459-61, bibl. 1.
From experiments described on Sturmer and Washington apples in New Zealand it appears that so small a dressing as ¼ lb. per tree of borax or boric acid might not give effective control of corky pit over a two year period. An application of ½ lb. per tree, however, would give effective control for this length of time.

400. Atkinson, J. D. 634.11-2.19 : 546.27
The effect of boron on bitter-pit of apples.
N.Z.J. Sci. Tech., 1937, **19** : 461-3, bibl. 2.
The many points of difference between bitter-pit and corky-pit are enumerated, showing clearly that their nature and origin are distinct. One characteristic distinction is the fact that whereas corky-pit may be practically eliminated by the application of boron compounds the incidence of bitter-pit is unaffected. The experiments from which these last conclusions are drawn were carried out in New Zealand in 1935-37 with Cox's Orange Pippins.

401. Dullum, N. 634.11-1.542.27
Frugtudtynding. (**Apple fruit thinning.**)
Beretn. Forsøksv. PlKult., Kbh. **308**, 1937, pp. 315-35, bibl. 8. [English summary ½ p.]
Fruit thinning experiments were made for several years at the Blangsted Research Station. All trees were on free-stock and were planted in 1917. The actual number of trees used in the

experiments is not stated but they included the following varieties :—Mølleskov, Wealthy, Lane's Prince Albert, Bellefleur de France and Codlin Springrove. The effect of thinning on cropping was found to be insignificant. The influence of thinning on the size of fruit was greater. With the exception of Wealthy, thinning increased the size of fruit by 11% on the average. Data compiled for a period of 5 successive years indicate that thinning does not influence biennial bearing, except in cases of heavy thinning (9/10 of the fruitlets removed) when a better regularity in bearing can be achieved. The last statement is based on a single instance of the comparative cropping of two trees, one very heavily thinned and the other not thinned.

402. Dickson, G. H. 634.11-1.51
A study of the extent to which apple orchard cultivation may be reduced.
Sci. Agric., 1937, **17** : 670-7.
This paper is a report of experiments carried out at the Ontario Horticultural Experiment Station from 1928 to determine the advisability of ceasing tillage of apple orchards and sowing the usual green manure crop earlier than is customary (15 July). The varieties were 8-year-old Baldwin, McIntosh and Spy with Duchess and Wealthy as fillers. One half of the plots received roughly 2 months more cultivation than the other. The green manures varied in kind but were the same throughout the plots for each year. Actually little difference resulted. Duchess and Spy and Wealthy produced more fruit under minimum cultivation while Baldwin and McIntosh produced more under the orthodox treatment. All the varieties except McIntosh made greater increase in trunk growth under the longer cultivation. There was little difference in soil moisture content between treatments. Soil nitrates varied greatly between treatments, being very much lower under minimum cultivation, and it is suggested that the limiting factor in this experiment may be nitrates rather than moisture.

403. Swarbrick, T. 634.11-1.542
The modified leader tree.
Sci. Hort., 1938, **6** : 229-41.
The merits and disadvantages of the open centre and modified leader tree form for apples are compared to the advantage of the latter, which has become very popular in America of recent years. It is claimed that the results of the modified leader type are to combine precocity with maximum size and, therefore, presumably, yield, and structural strength with rigidity. It is suggested that the open centre system delays initial bearing, presents a smaller bearing surface, is less fruitful—on the assumption that erect branches are less fruitful than horizontal ones—and is difficult to maintain. In addition the open centre tree is pulled out of shape, if bearing a heavy crop and the branches frequently break. The methods of building up a modified leader tree are fully described and are preceded by notes on growth principles and pruning practice. Pruning is regarded as a dwarfing and devitalizing process, its effects in this direction being directly proportional to its severity. It should be considered as a method of balancing both shoot and radial growth as between the several parts of a tree and its main effect is to reduce the vigour of the stronger growing shoots down to that of the weaker ones. Comparative growth and cropping reports between the two systems are to appear in the forthcoming report of Long Ashton Research Station, where investigation on the modified leader system have been in progress for some years.

404. Vasilinin, S. F. 634.11-2.111
Special methods of training fruit trees. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 3, pp. 55-6.
The severe climatic conditions in Siberia do not allow of the satisfactory cultivation of apple trees trained and pruned in a normal manner. The merits of the forms suggested by Zhuchkov and Krutovsky and Kisyurin's so-called melon mound form are discussed here and the last is stated to be the most useful for practical purposes.

405. Clements, H. F., and Engard, C. J. 631.542.24 : 581.143.27
Upward movement of inorganic solutes as affected by a girdle.
Plant Physiol., 1938, **13** : 103-22, bibl. 17.

From experiments described with a number of trees and shrubs it appears that the girdle, as a break in the continuity of the phloem, does not affect the upward movement of salts, but rather, as affecting the movement of water, influences the upward movement of salts in the xylem.

406. Srivastava, D. N. 634.13-1.547.5 : 631.542.24
Studies in the non-setting of pears. I. Fruit drop and the effect of ringing, dehorning and branch-bending.
J. Pomol., 1938, **16** : 39-62, bibl. 36.

The paper discusses experiments carried out by the author at East Malling Research Station during 1936 and 1937 to discover the causes of dropping of pear flowers and fruit and to ascertain whether dehorning, ringing or branch-bending would provide any relevant data. The shedding normally occurs in two waves (1) an early shedding of unfertilized flowers, and (2) the June drop of partially developed fruits. It is with (2) that the paper is concerned. Lack of fertilization did not seem to contribute to the June drop since most of the fruit dropped contained healthy seed and in any case other workers have shown that shrivelled seed in young fallen fruit does not necessarily mean non-fertilization. Examination of a pear tree in the very early stages of fruit formation will show that the clusters contain fruits of various sizes. Invariably, when the drop occurs, it has been found that the smaller the fruit the sooner it falls, thus indicating a failure in the competition for nutrition. This nutritional deficiency theory is supported by the fact that drastic dehorning increased the percentage set of fruit, presumably because more food was available for that part of the tree which remained. Ringing increased fruit bud formation but did not improve fruit set. Bending and tying gave variable results. [See also *H.A.*, 8 : 34.—Ed.]

Exports.

407. S. Africa, Union of. 634.1/2 : 382.6
Fruit production in the Union.* Report No. 15. The 1932-33 deciduous fruit export season.
Bull. Dep. Agric. S. Afr. **130**, 1936, pp. 48.

Statistical data are given in tabular form of deciduous fruit exports from the Union of South Africa.

408. S. Africa, Union of. 351.823.1 : 634.1/8 : 382.6
Regulations in respect of the export of deciduous and sub-tropical fruit. Govt. Printer, Pretoria, 1937, pp. 45.

This paper contains recent legislation governing the export of deciduous and sub-tropical fruit from the Union of South Africa.

409. Department of Agriculture, Adelaide. 634.11 : 382.6
Apple export.
J. Dep. Agric. S. Aust., 1937, **41** : 462-7.

The article deals briefly with the selection of fruit for export in S. Australia. Special attention is paid to finding the degree of maturity at picking most suitable for such fruit and the storage deteriorations following under- or over-maturity are also discussed.

* Notes from the Office of the Chief Inspector, Capetown.

SMALL FRUITS, VINES, NUTS.*

410. Andreichenko, D. A. 634.7
The wild berry fruit resources of Eastern Siberia. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 3, pp. 56-62.

During an expedition to Siberia, conducted in 1937 by the Mitchurin Institute of Fruit Production, a study was made of the wild berries. In the present paper the author deals with the currants, raspberries and bilberries found. The following notes are taken from the summary :— Wild berries were found to grow on an area of some 93,000 ha. This area is said to be suitable for practical exploitation. Some 86% of it contains types of bilberry (*Vaccinium Vitis-idaea* L., *V. Myrtillus* L. and *V. uliginosum* L.), 9% raspberries, 4% currants and 1% various others. The larger areas, on which berries grew, were marked on maps so that they may be easily found again. Further, the varietal composition of the wild berries was studied. The most valuable finds of the expedition are thought to be the brown currants B No. 13 and B No. 17 and the currant B No. 14, all of which were found in the Bodaibo District. A valuable raspberry, No. 4 I Zh., was found in the southern zone. Seed and plant collections were made of the 117 wild forms, each form being submitted to study by three institutes, the local branch stations Bodaibo or Tulun, Krasnoyarsk Experimental Station and the Mitchurin Institute of Fruit Production.

411. Dubrova, P. F. 634.7
Utilization of Siberia's wild berries. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 3, pp. 62-7.

Practical utilization is considered here of the finds made during the expedition conducted by the Mitchurin Institute to Siberia in 1937. Geographical position and average yields of the larger areas where berries grow are discussed as well as transport conditions and loss of time due to great distances and lack of organization. Table 3 shows the cost of production [i.e. picking.— Ed.] of wild berries per kg. in Siberia. It is estimated to be 3-4 times lower than that of wild berries and considerably lower than that of cultivated berries in the Middle Zone of the European part of the U.S.S.R.

412. Kostina, V. N. 631.523 : 634.725 + 634.711 + 634.75
Gooseberry hybrids at the Mleev Experimental Station. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 4, pp. 60-2.
Kostina, V. N.
The best raspberry hybrids at the Mleev Experimental Station. [Russian.]
Ibidem, pp. 62-3.
Zheleznikova, V. I.
New strawberry varieties bred at the Mleev Experimental Station. [Russian.]
Ibidem, pp. 63-4.

Brief reports are given of the breeding work which has been carried on for many years with various berry fruits at the Mleev Fruit Research Station. Some of the hybrids obtained are thought to be very valuable.

413. Schaffner, J. H. 581.145.1/2 : 634.38
Offspring of a self-pollinated reversed carpellate plant of *Morus alba*.
Bot. Gaz., 1938, **98** : 425-8, bibl. 2.

A reversed carpellate tree of *Morus alba* was self-pollinated and from the seed produced 24 trees, of which 4 did not flower, 5 were pure staminate, 8 were carpellate, 4 were staminate but with a few carpellate flowers, 1 was carpellate but had several catkins with some staminate flowers, and 2 were of decidedly mixed sex expression. From these and similar results obtained some years ago it is concluded that dioeciousness or unisexuality of *Morus* is not caused by hereditary differentials or by any of the newer factor hypotheses but by a physico-chemical or physiological condition,

* See also 542.

since both male and female individuals are potentially bisexual. It is shown that frequent sex reversals take place in trees of all ages.

414. Wallace, T. 634.711-1.8
A field experiment on the manuring of raspberries.
J. Pomol., 1938, **16** : 3-13, bibl. 2.

A manurial experiment with Lloyd George raspberries carried out from 1932 to 1937 is described. The treatments included farmyard manure, complete organic manure, complete inorganic manure, complete mixed organic and inorganic manures and the last named treatment with the omission of nitrogen, phosphate or potash. The plots receiving artificials all received the same amounts, viz. 50 lb. N, total phosphates 120 lb. (i.e. approx. 60 lb. P_2O_5) and potash 100 lb. K_2O. Manures were applied annually in March, the farmyard manure not being specially turned in. Potash deficiency was the chief problem of the area and greatly restricted cane growth and cropping ; nitrogen deficiency symptoms appeared during the last 2 years and were associated with decreased cane growth and fruit yield, the former being the more marked. The omission of phosphorus had no significant effect. The effects of the farmyard manure and the complete fertilizer were similar. It is remarked that no harm has resulted from the continuous use of a purely inorganic complete fertilizer on 2 of the plots since 1921 (under gooseberries till 1932).

415. Howell Harris, G. 634.711-1.811.7
Raspberry nutrition. III.* Are sulphates deficient in B.C. coastal soils ?
Sci. Agric., 1937, **17** : 707-12, bibl. 19.

Sterilization of soil from raspberry plantations where decline is prevalent in British Columbia resulted in a general increase of fertility (Cuthbert variety), because organic matter and several plant nutrients are thus made more available. The plants in the sterilized soil (in 12-inch pots) were about 6 times larger and more vigorous and healthy than the plants in the unsterilized soil growing under similar conditions (photographically illustrated). The increase of sulphate content in the sterilized soil was very marked and may have had beneficial secondary effects in increasing the availability of other replaceable bases.

416. Ministry of Agriculture, London (Oldham, C. H.). 634.75
Strawberries.
Bull. Minist. Agric., Lond., **95**, 1937, pp. 90.

This attractively produced book, written from a practical viewpoint, brings together a large amount of recent information on strawberry growing. Following historical notes, present day varieties are described and illustrated, with information on canning qualities. The areas of strawberry production in England and Wales and their production methods are described. Information is given on soils, manuring, cultivation, source of runners, harvesting, marketing and forcing. Full use is made of published data from British research and experimental centres. Though in many cases the last word has obviously not yet been said, this collection of data is very useful. Diseases and pests are, probably wisely, dealt with in the briefest manner, in only four out of the ninety pages. There are minor lapses (such as the spelling of " Madame Lefebvre"), and the information on variety distribution is in some cases out of date, but this is by far the best handbook yet available to growers and should be in the hands of everybody interested in strawberries. W.S.R.

417. Rogers, W. S., and Edgar, J. L. 634.75 : 581.084.2
Strawberry cultivation studies. I. The performance of individual plants of clonal families.
J. Pomol., 1938, **16** : 63-90, bibl. 8.

Individual plant records of 2,500 Royal Sovereign strawberry plants of selected clonal races were made from the time of their formation as runners on the parent plant to the end of their

* I. Seasonal variation of plant nutrients in raspberry plantings under different cultural treatments *Ibidem*, 1935, 15 : 525-33, *H.A.*, 5 : 372. II. Causes of raspberry failure in the coastal area of British Columbia. *Ibidem*, 1936, 16 : 353-7, *H.A.*, 6 : 284.

commercial life. Since every runner was planted out great variation in weight of runners was naturally found at planting, but all, irrespective of size, time of formation, position on the stolon or numbers produced by the parent, possessed the potentiality of becoming equally vigorous and fruitful plants when established. Such small runners, as had insufficient reserves to withstand the shock of transplanting and so either died or failed to catch up with the others, were always below the size used in normal commercial planting. A minimum weight of 3-4 g. for runners for planting is advised to avoid undue mortality (or about 8 washed runners to the ounce). The commercial life of the plants in these trials was limited by yellow edge virus disease, to which the earlier formed and larger runners showed a higher proportion of infection.

418. EDGAR, J. L. 634.75 : 581.084.2
Strawberry cultivation studies. II. Variability in individual plant size and cropping with special reference to area and shape of plots for field experiments.
J. Pomol., 1938, **16** : 91-100, bibl. 4.

The experience gained over a period of ten years showed that no great advance could be made in studies involving fine shades of differences in strawberry cultivation without occupying a fairly large area of ground, until more uniform material, such as would be provided by a clonal race, could be obtained. This was done and the results of the trials with clonal plants are noted in the previous article (see abstract 417). The great superiority of clonal material for experimental work over the normal commercial strawberries of previous experiments was demonstrated. Clonal plots of fifty plants at 3 ft. × 1 ft. 6 in. repeated 4 times will prove a 10% difference, but smaller plots with slightly higher replications are practicable, if guard rows are not necessary and if disease, particularly yellow edge, is kept under control. The greater efficiency of square plots over long narrow ones is demonstrated.

419. GUTIERREZ, M. E. 634.75
Progress report on strawberry tests at Baguio, Mountain Province.
Philipp. J. Agric., 1937, **8** : 391-416, bibl. 5.

Strawberries can be fairly successfully grown at 2,000 feet in the Philippines, though certain characteristics such as ease of culture, heavy runner production, size and quality of fruit, are reduced. Two varieties, Hood River and Wilson, however, can be recommended with confidence. Rooted plants previously established in nurseries will produce about double the yield when carefully transplanted compared to fragments of split-up clumps planted directly into the field (runners were not compared). Seedling plants from pure strains outyielded asexually propagated plants whether from runners or division. A compost containing partially decomposed pine needles from previous mulches was highly detrimental to size and number of berries. The pine needle mulch, as a mulch, gave higher yields, however, than other mulching materials such as straw or dust and its use is recommended, provided it is removed from the bed at the end of the season and that a rest is given to the field before replanting with strawberries. In manurial trials the best net returns were obtained with Pamco Leunaphos (16 N, 20 P_2O_5, 8 K_2O) plus sulphate of potash.

420. DARROW, G. M. 634.75 : 614.014.44 : 551.52
Breaking the rest period of the strawberry by long days at high temperatures.
Science, 1937, **85** : 391-2.

Successful attempts were made to break the rest period of American strawberries of widely differing growth types, including southern varieties which normally grow most vigorously in short days and northern varieties which grow slowly, if at all, under short-day conditions. The plants were submitted to temperatures of 70°, 60° and 55° F., the day length at all three temperatures being 16 hours, 14 hours, or normal winter day length in Maryland, i.e. 13-10 hours. The length of time during which the treatment was given also varied, some plants being treated as from 1 September when not yet resting, others from 15 November when already in the rest period and the rest from 1 January, and in this last lot the rest period had already been broken by previous exposure to low temperature. The additional daylight was supplied by 500 watt

Mazda lights hung 24 in. above the plants. The average leaf area on 2 March was noted and showed that submission to 16 hours daylight and to 14 hours daylight at 70° F. prevented a rest period in the 1 September group and broke the rest period in the 15 November group, previous exposure to low temperature having already broken the rest period in the 1 January group. At 60° F., 16 hour daylight treatment achieved similar but not such pronounced results, while a 14 hour daylight treatment allowed the 1 September plants to go into a rest period and did not break the rest period of the 15 November plants.

421. Crowley, D. J. 634.76
The cultivated cranberry in Washington.
Bull. Wash. St. agric. Exp. Sta., **349**, 1937, pp. 46, bibl. 4.
The cranberry industry has gradually gained in importance in western Washington. In this bulletin the essential points of cultivation are discussed, and notes are given on the choice of varieties, planting, weeds, pruning, frost injury, insect pests, diseases, harvesting and marketing.

422. Popova, Z. T., and Sosenskaya, E. Yu. 635.61 : 581.192
Chemical characteristics of the melon and water-melon species. [Russian, English summary 30 lines.]
Bull. appl. Bot. Leningr. 1936, Ser. III, No. **15**, pp. 215-27, bibl. 15.
The chemical composition of melons and water-melons was studied for some years at the biochemical laboratory of the Institute of Plant Industry. In this paper information on sugar content of these fruits is supplemented by data on polysaccharides, which were not considered in previous works. The following notes are taken from the summary :—Of all melons investigated *Cucumis eu-Melo* was found to be the richest in sugars, both as regards the total sugar content and, particularly, of sucrose. Fructose content predominated over glucose. The content of pectins and cellulose was found to be lower in *C. eu-Melo* than in other melons. Characteristics of *Cucumis agrestis* were :—a low sugar content, lack of sucrose, predominance of glucose over fructose and a high percentage of pectins and cellulose. *Cucumis microcarpus* and *Cucumis flexuosus* are stated to occupy an intermediate position between the two first named varieties as regards content of sugars and pectins, but as regards cellulose they come nearest to the cucumber, *Cucumis sativus*. Of the water-melons the highest percentage in total sugars, and particularly in sucrose, was found in *Citrullus edulis*. Fructose predominated over glucose, and the amount of pectins and cellulose were inconsiderable. A low sugar content, traces of sucrose, predominance of glucose over fructose and an extremely high percentage of pectins and cellulose were found to be characteristic of *Citrullus colocynthoides*. *Citrullus fistulosus* and *Citrullus Colocynthis* were found to occupy an intermediate position as regards the total content of sugars, sucrose content, fructose-glucose ratio and content of pectins and cellulose. It was observed that the table varieties of melon and water-melons steadily accumulated sugars and among them sucrose, as they ripened. In the wild forms, containing large amounts of polysaccharides, the sugar content remained the same at the different stages of development, sucrose being altogether absent. As regards their sugar dynamics the forage melon behaved like the table varieties while the forage water-melon approached more closely the wild form.

423. Porter, D. R. 635.615 : 632.48
Breeding high-quality wilt-resistant water-melons.
Bull. Calif. agric. Exp. Sta. **614**, 1937, pp. 43, bibl. 25.
Several water-melon varieties were found to be resistant to wilt, *Fusarium niveum*, when grown in California, but none of them manifested satisfactory quality. As a result of continued propagation of resistant stock of the varieties Klondike and Grey Monarch the author obtained new varieties, resistant enough to produce profitable crops on severely infested soil. A detailed

account is given of some of these new varieties. Notes are given on commercial seed production and on possible future developments in water-melon breeding.

424. DIX, I. W., AND MAGNESS, J. R. 634.8
American grape varieties.
Circ. U.S. Dep. Agric. **437**, 1937, pp. 33, bibl. 6.
Approximately 230 varieties of American grapes have been tested at the Arlington Experiment Farm, Virginia, for periods of 5 to 20 years. In this bulletin a detailed description is given of the varietal characteristics of the principal varieties, including both those of native species and those obtained by hybridization of such species with the European, Asiatic and African varieties of *Vitis vinifera* L. Neither the muscadine varieties nor *Vitis vinifera* varieties introduced from the Old World and now being grown only in some parts of the U.S. are discussed. The report is tabulated.

425. DEARING, C. 634.848
Muscadine* grapes.
Fmrs' Bull. U.S. Dep. Agric. **1785**, 1938, pp. 36.
In this bulletin information is given accumulated by the U.S. Department of Agriculture over many years on muscadine grape varieties. Notes are given on the essential points in their cultivation, the choice of varieties, pests and diseases.

426. BREIDER, H., AND SCHEU, H. 634.835 : 575.18
Die Bestimmung und Vererbung des Geschlechts innerhalb der Gattung Vitis. (**Sex determination and sex heredity in the genus *Vitis*.**)
Gartenbauwiss., 1938, **11** : 627-74, bibl. 47.
A report containing valuable information for the geneticist of the investigations made into the law of sex heredity in the genus *Vitis*. The studies were conducted by the Kaiser Wilhelm Institute at Müncheberg. The present study will be supplemented by further investigations into the biology of the flower and the history of development of the genus.

427. STIEVANO, M. 631.51 : 634.8
Préparation du terrain avant la plantation des vignes américaines. (**Preparing the ground for planting American grape-vines.**)
Tunisie agric., 1938, **39** : 17-8.
If in Tunis American vines are to be planted on the site from which vines have just been removed, the ground should be allowed to be fallow for 3 years. The summer before planting the ground must be worked by hand or mechanically to a depth of at least 60 cm. If mechanically, the couch grass should be destroyed previously. If the grower has not the means to clean the whole field trenches to take the vines may be opened not less than 70 cm. deep, the top soil being reserved to place round the roots of the vines. Planting in holes or in unworked ground is futile. Instructions are given for checking erosion by means of contour planting and ditching.

428. CAILLOUX, M. 631.51 : 634.8 + 634.63
Défoncements et sous-solages à grand profondeur. (**Deep working and sub-soiling.**)
Tunisie agric., 1938, **39** : 19-24.
The uses and methods of deep working and sub-soiling on Tunisian plantations, chiefly olive and vine, are discussed and comparisons are drawn between olive groves which had been deep- and shallow-worked respectively previous to planting. Inferior results were produced by the shallow working. Although mechanical traction on large vineyards is a necessity, the most efficient work is still done by hand. Various kinds of tractors and implements are mentioned and the costs of labour in Tunis are worked out.

* *Vitis rotundifolia* Michx. and *V. Munsoniana* Simpson.

429. PIGUET, G. A. 634.8-1.543.8-1.542
Étude sur l'influence de divers écartements et de diverses tailles sur la quantité et la qualité de la récolte. **(The effect of spacing and pruning on the quality and quantity of the grape harvest.)**
Reprinted from *Annu. agric. suisse, 1937*, pp. 1159-74.

Investigations were carried on at the Swiss Federal Research Station, Lausanne, from 1919-36. The author reaches the following conclusions :—1. Both quantity and quality of crop in vines trained as cordons were as a rule not inferior to those of vines trained on different types of trellis. 2. No marked difference was observed in the behaviour of ascending or descending cordons. 3. The manner in which the shoots were fastened seemed to have a considerable influence on grape production. 4. Systems whereby two bearers are tied together or two tied to three or no tying at all is done do not seem to result in the highest or best quality crops. 5. The more common method already adopted in Swiss vineyards of tying the bearers to form goblets at an early stage in growth appears to give the best results both quantitative and qualitative.

430. WILHELM, A. F., AND ZILLIG, H. 634.8 : 581.144.3
Die Kennzeichen der Holzreife bei Weinreben und Untersuchungen darüber an wichtigen Rebsorten. **(Signs indicating wood maturity in vines and trials on the subject with the more important vine varieties.)**
Gartenbauwiss., 1938, **11** : 413-30, bibl. 15.

The degree of maturity of the current year's wood growth plays a great part in the propagation of vines as well as in setting of fruit, formation of shoots and development during the following year. In the present paper the more reliable signs indicating the stage of maturity in the wood of the vine are discussed. Trials made with commercial European and American vine varieties are described. These were conducted in February and March 1937 by the branch station of the Biological Institute of the Reich Department of Agriculture and Forestry, Bernkastel-Kaes-on-Mosel. The formation of the periderm and of the secondary bark as well as the starch content were considered to be the more reliable signs of maturity. The article is well provided with tables and figures. The chief results may be summed up as follows :—1. The presence of a periderm entirely enclosing the vine shoots is an indispensable condition for their maturity. 2. Groups of hard and soft basts in the bark between the nodules of different stages showed divergencies. The smallest number of hard basts was found to be on the so-called " channelled side " (Rinnenseite), the wood of which should, therefore, be considered as the least mature. The authors suggest that the phenomenon described as " Rückendarre ", or back drying, of vine suckers may be attributed mainly to an unsatisfactory development of the channelled side. Therefore, in the author's opinion, one would as a rule have to ascribe a low degree of maturity to vine woods forming no hard bast groups at all on one side. 3. A consistent relation was found to exist between the starch content and the degree of maturity both in parts of shoots and in entire shoots of different varieties. In addition to well-known external signs which denote maturity, callusing of two-eyed cuttings was also used. The degree of maturity found by starch content was as a rule confirmed by this method. Finally practical methods for determining the extent of periderm formation and starch content are described.

431. KORDES, H. 634.8 : 577.15.04
Bedeutung der Wuchsstoffe für die vegetative Vermehrung der Rebe, insbesondere für die Rebveredlung. **(The importance of growth stimulants for vegetative propagation of vines, and particularly for grafting.)**
Gartenbauwiss., 1938, **11** : 545-54, bibl. 2.

Experiments were made in spring 1937 with β-indolylacetic acid (strength ·0025% for cuttings and ·01% for grafts) at the Neustadt a.d. Weinstrasse State Research Institute. The effect of the stimulants was studied on dormant cuttings* and on four varieties grafted to rootstock 5BB. These varieties were Traminer, Silvaner, Riesling and Burgunder. The stimulant was used in the form of a solution, which was obtained from the Merck Chemical Factory in Darmstadt. The vines were treated with the stimulant solution and the control vines with water for 16 hours.

* Of the 5 varieties mentioned later.

When treated with β-indolylacetic acid Riesling, Traminer and Silvaner cuttings showed a particularly strong increase in root growth but Burgunder was less affected and Portugieser scarcely at all. This fact is thought to indicate that optimum concentrations of β-indolylacetic acid vary for different varieties. The use of the stimulant in grafting trials produced an increased root growth of the stock, but scion varieties also formed roots at the point of the union, Burgunder scion variety proving the only exception. The author indicates that the methods of treating vines with the stimulant should be modified in order to avoid the undesirable effects noted in the present experiment, namely root formation of the scion at the point of union, and a premature development of roots on the stocks before transplanting, which is harmful. The report is tabulated and figures are given.

432. KACZMAREK, A. 634.8 : 581.162.3
Zur Frage der Keim- und Befruchtungsfähigkeit des Pollens der weiblichen Rebenblüte. **(On the question of germinability and fertility of the pollen of female vine flowers.)**
Gartenbauwiss., 1938, **11** : 483-522, bibl. 39.
In 1929-35 experiments were made with pollen of so-called female vine flowers at the branch station of the Reich Biological Institute of Agriculture and Forestry in Naumburg-an-S., 135 vine varieties being submitted to trial. Trials were made both of putting the female pollen grains on nutrient medium and of cross pollinating female vines. Although in the earlier experiments a certain amount of germination took place, none whatever occurred once adequate precautions had been taken to prevent the presence of outside pollen, and the author, therefore, concludes that reports of the germinability of such pollen in the past may be attributed to faulty technique.

433. VINET, E. 634.8-1.8
Action sur la vigne de la fumure carencée en potasse et en azote. **(Effect on vines of manuring deficient in potassium and nitrogen.)**
C.R. Acad. Agric. Fr., 1937, **23** : 774-82.
The results of 5 years' tests of the application of complete fertilizer compared with complete fertilizer less potash and of 7 years' tests of the application of complete fertilizer compared with complete fertilizer less nitrogen are set out briefly in tabular form showing the average weight of 1 m. of shoot, average diameter, % K_2O in dry matter of wood, number of bunches per plant, average weight of bunches, crop per hectare and sugar produced per hectare. The conclusions based on these data are as follows :—The application of a fertilizer dressing deficient in potash or in nitrogen to a soil where the deficient elements can be utilized, may in course of time provoke and aggravate in the vine an upset in the general health of the plant which is prejudicial to its production and can finally become pathological. In the latter condition the vine tends to show open symptoms of physiological disorders. Such symptoms are not always, in our opinion, the mark of a mineral deficiency. Wood diagnosis on the other hand is very important and suffices as a basis of diagnosis. It has allowed us in our trial grounds to track down potassic and nitrogenous deficiencies before any appearance of outward signs. From a practical standpoint both of these deficiencies have the same result—a smaller crop. Our experiments essentially show the necessity for complete manuring.

434. MINISTRY OF AGRICULTURE, LONDON (HOARE, A. H., AND HAMOND, J. B.). 634.51 + 634.54
Nuts.
Bull. Minist. Agric., Lond., **106**, 1937, pp. 36, bibl. 7 cobs and 17 walnuts.
Cob-nuts and filberts. The author (A. H. Hoare) starts by distinguishing between the cob and the filbert. Filberts are completely covered by the husk, and in cob-nuts the husks are shorter than the nuts. Hence the so-called Kentish cob-nut is really a filbert. He next gives a short historical and botanical survey of the *Corylus* nuts in general. These nuts are cultivated all over Great Britain, but produced on a commercial scale only in Kent. The cultivated varieties are classified into six groups. Cob-nuts succeed on a variety of soils. In Kent nuts are usually

planted on the poorer soils where other fruit trees do not grow so well. Better crops are obtained on richer but not excessively rich soils. The layering method of propagation is recommended and described. Cob-nuts are monoecious, the blooming period starting in February and lasting a month. They are self-fertile, but filberts tend to be unfruitful unless two varieties that blossom together are interplanted. Kentish cobs are planted 15 ft. apart, bush fruits being planted between them to give some return while the nut-trees are developing. Hard winter pruning was formerly advocated, but recently more modified systems of pruning have been introduced. Reasons for the two methods are given. Summer pruning is also described. Cob-nuts derive benefit from cultivation and fairly generous manuring. A suitable schedule of organic and inorganic manures is recommended. A yield of 4-5 lb. per tree is usual six years after planting. After this the crop increases to from 6 to 10 cwt. per acre and may be as high as 2 tons per acre. A review is given of the pests and of a disease commonly attacking cob-nuts and filberts. Of these the nut weevil (*Balaninus nucum* L.) and caterpillars of the winter moth group are the most serious. Both these pests may be controlled by spraying with lead arsenate. *Walnuts.* The English walnut is known as *Juglans regia* L. The tree is monoecious, pistillate and staminate flowers being distinct, although borne on the same tree. Other walnut species are described briefly, and the principal uses of walnut timber are mentioned. Walnut trees in England are nearly always grown from seed and frequently bear inferior nuts, in comparison with those grown abroad, which are borne on vegetatively raised trees of named varieties. An attempt to improve English walnuts by raising grafted trees is being made. Seven established English trees and four well-known French varieties have been selected for propagation in this country. At present young trees are raised by grafting under glass, as little success has been obtained out of doors. One-year-old seedling rootstocks of *J. nigra* or *J. regia* have been used for grafting, as walnuts do not root easily from cuttings or layers. Seedling rootstocks will be replaced by layered rootstocks as soon as these are available in sufficient numbers. The preparation of scions and methods of spring and summer grafting, using the double whip-and-tongue graft, are described with illustrations. Out-door budding has given more promising results than grafting and mention is made of a successful technique, still in an experimental stage, in which dormant buds from the previous season's growth are used. Walnuts prefer a deep, fairly heavy loam soil containing plenty of lime. Good drainage is essential. The pistillate flowers are very susceptible to freezing, so that low sites should be avoided. Walnuts should be planted at least 40 ft. apart, and the ground kept cultivated until they are established. Methods of pruning recommended to produce a standard walnut or a small bush tree are discussed. In considering walnut storage problems emphasis is laid on the importance of harvesting the nuts as soon as they fall and on effective cleaning of the shells. Nuts should also be bleached to improve their appearance and to make them more resistant to fungi. The temperature and the humidity of the atmosphere are factors to be considered before deciding where walnuts may be stored. If clean, bleached nuts are placed in a mixture of salt and coconut fibre, they may be stored successfully under private cellar conditions. Bacterial blight is the most important disease of walnuts. Bacteria attack all young growing parts of a tree, often causing nutlets to fall when very small. Control measures include spraying and cutting out diseased wood in which bacteria pass the winter. Two fungus diseases which attack walnut grafts and established trees respectively are described briefly. Mention is made of four pests found on walnuts, none of which is important.

PLANT PROTECTION OF DECIDUOUS FRUITS.*

435. Steinmetz, F. H. 632.111 : 634.11

A histological evaluation of low temperature injury to apple trees.

Bull. Me agric. Exp. Sta. **388**, 1937, pp. 32, bibl. 55.

Histological characteristics of low temperature injury to apple trees and methods of predicting accurately the extent of recovery were studied at the Maine Agricultural Experiment Station. The following notes are taken from the author's summary :—The effect of low temperature

* See also 396-400.

injury to *Pyrus Malus* L. is the death of protoplasts in the parenchyma, followed by an occlusion of the vessels by a substance resembling wound gum. The dead cells and the occluded vessels form the so-called " black hearted wood ". The recovery of injured wood is said to be dependent on the development and maintenance of sufficient foliage to promote growth, and to be also determined by environmental conditions. Anatomically recovery is possible only if some storage cells remain alive and the xylem remains capable of conduction. In none of the trials was the dormant cambium found to be injured. Microscopic studies indicate that branches with approximately 50% killed vessels will not recover, but that recovery is probable if only 25% are killed. If approximately 50% of the parenchyma cells are dead, the branches may not recover, but if only 20% are killed, they probably will. The author supports his statements with tables, graphs and figures and reviews the considerable literature on the subject.

436. Wenzl, H. 634.13-2.19
Marmorierte Panaschierung von Birnblättern. (**Leaf-mottle in pears.**)
Gartenbauwiss., 1938, **11** : 621-6, bibl. 2.
In 1936 some observations were made in a nursery near Vienna on 5 two-year-old pears of the variety Gellerts Butterbirne, the foliage of which showed a partial white mottling. The phenomenon, which is not beautiful, is attributed to bud mutation.

437. Wiant, J. S. 635.61 : 632.3/4
Investigations of the market diseases of cantaloups and Honey Dew and Honey Ball melons.
Tech. Bull. U.S. Dep. Agric. **573**, 1937, pp. 47, bibl. 57.
In 1931-35 investigations into the market diseases of cantaloups and of Honey Dew and Honey Ball melons were made by the U.S. Department of Agriculture. The more important diseases were found to be *Fusarium* rot, *Rhizopus* soft rot, *Alternaria* rot, *Cladosporium* rot, *Phytophthora* rot, charcoal rot (*Rhizoctonia bataticola*), *Diplodia* rot, and pink mould rot (*Cephalothecium roseum*). Illustrated descriptions of the symptoms of these diseases are given, their history and importance discussed, and studies of the causal organisms reported in connexion with temperature studies. Measures for the control of the diseases are suggested. Bacterial soft rot, anthracnose rot and blue mould rot (*Penicillium* spp.), which are said to cause less deterioration of these cantaloups and melons on the New York market, and several other diseases of minor importance are also discussed.

438. Bodine, E. W., and Durrell, L. W. 632.8 : 634.25
The Maynard plum—a carrier of the peach mosaic virus.
Science, 1937, **86** : 81.
Grafting experiments in Colorado in 1936 with the Maynard plum show that this variety may carry the peach mosaic virus without showing the symptoms evident in infected peaches.

439. Turnbull, J. 632.941 : 634.1/2
Fruit tree spraying in 1937.
J. Minist. Agric. Lond., 1938, **45** : 16-22.
Four-nozzle heads throwing parallel sprays, made in error with the nozzle centres 4 in. apart instead of the recommended $3\frac{3}{8}$ in., showed a striking inferiority in performance, failing to carry as far by 6 or 8 ft. and resulting in under-spraying the tops of tall trees and over-spraying the lower branches. For efficiency and comfort of working the 4-nozzle head lance must not exceed 4 ft. in length. The nozzle pressure necessary to reach tall Bramley apple trees is 450 lb. per sq. in. Using these lances with pressure raised to 500 lb. per sq. in. at the nozzle each man sprayed 5 acres in each complete spraying day plus one hour overtime with less fatigue than when covering only half the quantity of wood the previous year (type used then not stated). Methods of mobile spraying used on various fruit farms are discussed. The spraying, if the outfit is tractor drawn, may be done without stopping from tree to tree provided the pump and nozzle capacity are adequate, otherwise the work is improperly done and stopping and starting at each

tree must be insisted on. Methods of avoiding the delay at refilling, which is usually 20 minutes, are considered. On one farm bringing a full trailer tank by tractor or hose to the outfit and removing the empty one to refill reduced the delay to 2 minutes. One or two lances each with 3 or 4 nozzles may be used. Bad work is often due to inferior pump capacity and the practice of manufacturers of quoting pump outputs that have been worked out on paper and bear no relation to the actual (and always lower) output is condemned. A sign that something is wrong is any variation in one spray when another is turned on or off. Pump pressure gauges, when not new, are often unreliable. The grower is recommended to depend on his eyesight. Other conclusions are :—A 2 ft. lance with double nozzle is adequate for bush trees and fruit bushes, a 4 ft. lance with triple nozzle with 15° bend and 4/64 in. discs is best for half-standard trees and gives better results than a double nozzle with 5/64 in. discs. The sizes of discs required are 4/64 in. for a nozzle pressure of 350-500 lb. per sq. in. and 5/64 in. for pressure of 200-250 lb. For a long drive a 7-hole swirl plate is best and for close work a 6-hole plate, omitting the centre hole.

440. Cheal, W. F. 632.42 : 634.11
Apple scab spraying experiments in the Wisbech area. IV.
J. Minist. Agric. Lond., 1938, **44** : 1184-8.
Observations on the incidence of scab in spring were made in the course of the author's advisory and experimental work in the Wisbech area. They show that, in several seasons, scab-infection occurred on Bramley's Seedling prior to pink-bud, thus making it essential to apply a protective fungicide in addition to and earlier than that at pink-bud in order to obtain successful scab control on Bramley's in that area. M.H.M.

441. Friedrich, G. 632.42 : 634.11
Eine einfache Kontrolle des Fusicladiumsporenfluges. (**A simple method for determining the flight of the spores of *Venturia inaequalis* (Cooke) Aderhold.**)
Gartenbauwiss., 1938, **11** : 457-61, bibl. 5.
In this paper different methods are discussed for determining the degree of infestation of orchards by *Venturia inaequalis* spores. The author used a simplified method of trapping the spores which is described here in full with illustrations. It is said to combine the best points of earlier methods recommended by Keitt and Jones (*Bull. Wis. agric. Exp. Sta.* 73, 1926) and others. The practical value of this new method is that strong flights of spores can be determined in a few hours' time, thus enabling the fruit grower to start spraying while the spores are still germinating, provided weather conditions are favourable.

442. Cheal, W. F., and Weston, W. A. R. D. 632.42 : 634.13
Observations on pear scab (*Venturia pirina* Aderh.).
Ann. appl. Biol., 1938, **25** : 206-8, bibl. 4.
Certain observations on the initial infection and source of pear scab are made which are considered to have a direct bearing on control measures and to indicate the importance of pre-blossom fungicide sprays and their thorough application to older wood. In heavy infections of scab much more than a single pre-blossom and a single post-blossom spray are needed.

443. Gante, T. 634.72-1.521.6-2.4
Zur Resistenzzüchtung gegen *Pseudopeziza ribis* Klebahn. I. Beitrag zur Kenntnis der Infektionsbedingungen und der Kultur des Pilzes. (**Breeding of *Ribis* varieties resistant to *Pseudopeziza Ribis* Klebahn. I. A contribution to the question of infection conditions and of cultivating the fungus.**)
Gartenbauwiss., 1938, **11** : 675-96, bibl. 16 lines.
The more important literature on this subject is reviewed and the author's own experiments are described in full. Studies were made with cultivated fungus on several varieties of currants and gooseberries. The experiments were carried out at the Kaiser Wilhelm Institute in Müncheberg.

444. MARSAIS, P. 634.8-2.4
Le court-noué parasitaire de la vigne. **(Court-noué, a parasitic disease of the vine.)**
C.R. Acad. Agric. Fr., 1937, **23** : 954-60.
The conclusions of the late P. Viala as to the parasitic nature of court-noué have recently been fully confirmed in Austria, Germany, Czechoslovakia and Yugoslavia. The parasite is *Pumilus medullae*, and its most obvious effect is the stunting of stem and shortening of the internodes. In Germany inoculations were made of the stock-scion union callus with a pure culture of *P. medullae* prior to stratification. On planting out the inoculated grafts started into growth, but the growth made was feeble and showed evident signs of court-noué. In Czechoslovakia cultures made from the pith of diseased vines were inoculated into healthy vines in pots and court-noué symptoms were induced. Austrian experiments directed to analysis of diseased vines indicate that the parasite checks the growth of the vine shoot by depriving its tissues of phosphorus, which is essential for nutrition and cell division.

445. ANON. 632.411 : 634.8
Le mildiou de la vigne (*Plasmopara viticola* (B. et C.) Berlese et de Toni). **(Vine mildew.)**
Memento Déf. Vég. Rabat, **47**, 1937, pp. 14.
Symptoms of and extent of damage caused by *Plasmopara viticola* are described. Control measures are discussed and short lists are given of varieties which show marked resistance, a certain degree of resistance and extreme susceptibility to mildew.

446. KEITT, G. W., BLODGETT, E. C., WILSON, E. E., AND MAGIE, R. O. 632.42 : 634.23
The epidemiology and control of cherry leaf spot.
Res. Bull. Wis. agric. Exp. Sta. **132**, 1937, pp. 117, bibl. 116.
This long investigation on the cherry leaf spot (*Coccomyces hiemalis*) disease of the sour cherry (*P. Cerasus*) was begun at Wisconsin in 1914 and has been continued ever since with the exception of 1919 and 1920. Several progress reports have been issued. The work has been directed along two chief lines, namely, field studies of development and control in relation to the play of the natural environment, and laboratory and greenhouse studies of the disease and its prevention under partly controlled conditions. Numerous details are given of spore germination and conidial infection studies. The only known type of natural overwintering of the fungus is in the dead leaves as stroma-like bodies containing ascocarp initials. Ascospores appear to be the only important primary inoculum produced under natural conditions in Wisconsin. Secondary infection commonly occurred in successive waves traceable to specific infection periods and quickly assumed epidemic proportions under favourable conditions of inoculum, moisture and temperature. Control experiments are very thoroughly considered. Bordeaux spray 3-4-50, using high calcium hydrated lime gave the best control. This was applied (1) just after petal fall when $\frac{3}{4}$ of the petals were off and ending within 5 days, (2) about 2 weeks later, and (3) just after harvest. Lime sulphur, 1-40, gave the best results of the dilutions studied.

447. KOLESNIK, L. V. 634.11-2.753
634.8-2.753
The enzymatic activity of apples and grapes in relation to their resistance to *Eriosoma lanigerum* Hausm. and *Phylloxera*. [Russian, English summary 17 lines.]
Bull. appl. Bot. Leningr., 1936, Ser. III, No. **14**, pp. 69-78, bibl. 18.
A preliminary report of the studies started in the spring of 1935 by the Immunity Department of the Enzymatic Laboratory of the Institute of Plant Industry in U.S.S.R. The activity of catalase, oxidase, peroxidase and amylase in a number of apple and grape varieties was studied, in an attempt to differentiate them according to their resistance to *Eriosoma lanigerum* Hausm. and phylloxera respectively. Data indicate that the specificity for adaptation of each of the

above parasites to the activity of the catalytic processes of their hosts can be determined. Thus, the resistance of grapes to phylloxera is correlated with a high activity of catalase, oxidase and peroxidase, while in apples immunity and resistance were found to be related to a low activity of these ferments. The differences in the activity of catalase from the leaves of grapes of resistant and susceptible varieties is more clearly detected in the top leaves but of oxidase in the leaves near the centre. The saccharification activity of amylase of apples showed an inverse relationship as compared with the ferments of the oxidation group. The resistance of both apples and grapes is correlated with an increased activity of amylase.

448. Bovey, P. 632.78 : 634.22
Recherches sur le carpocapse des prunes *Laspeyresia* (*Grapholita*) *funebrana* Tr.
(The oriental peach moth).
Reprinted from *Rev. Path. veg.*, 1937, **24** : 189-317, bibl. 75.
This paper deals very fully with the bionomics of the oriental peach moth (*Laspeyresia funebrana* Tr.).

449. Knowlton, G. F., and Smith, C. F. 634.75-2.6/7
Strawberry insects.
Reprinted from *Contr. Dep. Ent. Utah agric. Exp. Sta.*, 1935, pp. 289-92.
Anatomical descriptions are given of the strawberry leaf roller (*Ancylis comptana* var. *fragaarie* W. and R.) and the strawberry root weevils *Brachyrhinus ovatus* L. and *B. rugostraitus* Goeze. Control measures against the strawberry root weevils are described briefly. Mention is also made of a number of other insects, which damage strawberries in Utah.

450. Mundinger, F. G., and Hartzell, F. Z. 632.771 : 634.13
The pear midge : orchard studies and experiments for its control.
Tech. Bull. N.Y. St. agric. Exp. Sta. **247**, 1937, pp. 75, bibl. 32.
For a series of 10 years investigations have been made in the Hudson Valley and in Western New York into practical methods for controlling the pear midge (*Contarinia pyrivora* Riley). A study was made of the critical period of bud development and midge activity at which control is possible as well as of the effectiveness of dusts and sprays under commercial conditions. The results were recorded for Clapp's Favourite, Bartlett, Kieffer, Sheldon, Seckel, Bosc and D'Anjou pear varieties growing in different orchards, the actual number of trees not being stated. The critical period was found to be that time, when the most advanced blossom buds in the warmest part of the orchard begin to show the pink of the petals between the separating sepals. Control was most effective when spraying took place at the critical period with mixtures containing nicotine or with summer oil emulsion without nicotine, although a thiocyanate (lethane) used in the 1936 trials appeared to be promising for the control of this insect. Nicotine sulphate at the rate of from $\frac{3}{4}$ to 1 pint in 100 gallons of spray mixture was used with either lime-sulphur or bordeaux, soap or summer oil. Summer oil emulsion was used at the rate of 1·7 to 2 gallons of actual oil in 100 gallons of spray mixture. Except for the seasons when midge activity was prolonged and flower bud development delayed, in which case two applications of the more effective mixtures were necessary, commercial control was obtained by a single treatment of the trees. Notes are given on the application of the treatment.

451. Knowlton, G. F., and Allen, M. W. 634.717-2.78
Oblique-banded leaf roller, a dewberry pest in Utah (*Cacoecia rosaceana* Harris).
Reprinted from *J. econ. Ent.*, 1937, **30** : 780-5, bibl. 1.
In the present paper the life history is described of the oblique-banded leaf roller which infests dewberry fruits in several localities in northern Utah. The authors recommend careful spring pruning and prompt burning of pruned canes as well as hand picking and destruction of infested leaves before 15 May, as being adequate control measures. A note is also made of certain parasites which might possibly prove useful for biological control.

452. RIPLEY, L. B., PETTY, B. K., HEPBURN, G. A., AND VAN DER WESTHUYSEN, J. P. 632.78 : 634.973.737

Control of the wattle bagworm (*Acanthopsyche junodi* Heylaerts) by dusting with natural cryolite.

Sci. Bull. Dep. Agric. S. Afr., **152**, 1936, pp. 22, bibl. 4.

For many years dusting experiments have been made with natural cryolite both in the field and in the laboratory. The results indicate that dusting may be adopted by growers as a method for controlling the wattle bagworm. The advantages and limitations of this method are discussed here in full, all data, including costs, being given.

453. ANON. 632.76 : 634.8

L'altise de la vigne. (***Haltica ampelophaga* Guer. on vines.**)

Memento Déf. Vég. Rabat, **49**, 1937, pp. 9.

In this bulletin an anatomical description is given of *Haltica ampelophaga* Guer. as well as its life history and its control. This parasite causes serious damage to vines in Morocco.

454. STELLWAAG, F. 632.952

Vorläufige Ergebnisse von Untersuchungen über den Ersatz arsenhaltiger Bekämpfungsmittel im Weinbau. (**Preliminary results of the search for a substitute for arsenical insecticides in the vineyard.**)

Gartenbauwiss., 1938, **11** : 537-44, bibl. 27.

The author's 10 years' experiments at Geisenheim with a large number of organic and inorganic substances has not been successful in producing any insecticide which can really be considered an adequate substitute for arsenic. The qualities of various substitutes tried are discussed.

455. THOMSON, R. H. K. 632.954

The effect of prolonged agitation on the chemical composition of lime-sulphur spray.

Orchard. N.Z., 1938, **11** : 25.

Experiments at the Cawthron Institute, N.Z., established that lime-sulphur spray of summer strength was changed by aeration caused by prolonged agitation : the polysulphide content was reduced to zero and the amount of free sulphur and calcium thiosulphate present was increased. These changes greatly diminish the fungicidal properties of the spray, cause a deposit in the spray tanks and decolourization of the mixture. They can be reduced or avoided if excessive agitation or prolonged exposure to air of the spraying mixture be avoided, and to bring this about it is suggested that smaller quantities of this spray should be prepared at a time.

456. WALKER, G. L. 632.951

New wetting and spreading agent for spray materials.

Reprinted from *J. econ. Ent.*, 1937, **30** : 962 : 7, bibl. 3.

A sodium salt of water-soluble petroleum oil sulphonates known as Ultrawet seems to possess desirable qualities as a wetting and spreading agent in U.S.A. Combined with half the ordinary strength of dry lime-sulphur it controlled apple scab nearly as well as a full strength dry lime-sulphur and reduced injury caused by the lime-sulphur lead arsenate combination. It also gave increased control when added to cubé root dust against potato flea beetle, onion thrips and European corn borer, but failed to increase protection against Mexican bean beetle, cucumber beetle and cabbage worm and looper.

457. ECKERT, J. E., AND MALLIS, A. 632.796

Ants and their control in California.

Circ. Calif. agric. Exp. Sta. **342,*** 1937, pp. 37.

The life history and habits of ants are here described. Descriptions are given of the Argentine ant and other ants common in California and their control is discussed.

* Superseding *Bull.* 207.

458. DEPARTMENT OF AGRICULTURE, MALTA. 632.79
Control of mole cricket.
Annu. Rep. Dep. Agric. Malta, 1936-7, pp. 37-8.
Ten treatments were tried on fields heavily infested with mole crickets. Neither soil treatment with different doses of naphthalene or with carbon bisulphide nor planting on ridges checked the pest nor at the time did the distribution of heaps of dung about the field, but 159 mole crickets were collected from time to time from these heaps and the land was thus cleared of them with great advantage to the succeeding crops. Naphthalene attracted the crickets which then destroyed the crop but there is reason to believe that they subsequently perished. The use of zinc pipes 6″ or 4″ long [presumably sunk endways to the level of the soil as in Morocco. —ED.] proved a very effective and cheap method. Phosphorine used as a poison was also very effective but was too dangerous for general use.

459. FLANDERS, S. E. 632.96
Habitat selection by *Trichogramma*.
Reprinted from *Ann. ent. Soc. Amer.*, 1937, **30** : 208-10, bibl. 7.
Based on his own studies and on the literature cited the author reports that *Trichogramma evanescens* prefers field habitats, *Trichogramma embryophagum* arboreal and *Trichogramma semblidis* marsh habitats. Although not restricted to one type of habitat, these species are stated to be rarely found associated. It is indicated that within a favourable habitat the type of plant surface determines the amount of parasitism. Differences in the crawling and flying habits of this useful family of insect parasites are attributed to habitat adaptations.

460. POOLE, A. L. 632.51
Botanical studies on ragwort.
N.Z. J. Agric., 1938, **56** : 83-90.
The ragwort (*Senecio Jacobaea*), a dangerous imported weed, and its life history in New Zealand are described with special emphasis on rooting-habit and seed production. Various experiments in hand control are described such as cutting down, defoliating and pulling up by the roots, of which the latter was the most effective. Since fragments of root left in the ground will produce new plants, it is advisable to loosen the soil with a fork if the ground is hard. The uprooted plants must be at once destroyed if near the flowering stage, for if left on the ground they may still ripen seed. Over 50% control was obtained in the wet season with the plants in flower. It is considered that this would be higher in the dry season.

461. COOK, W. H. 632.954
Chemical weed killers. I-V.
Canad. J. Res., 1937, **15**, Sec. C., pp. 299-323, bibl. 6, 380-90, bibl. 5, 442-9, bibl. 3, 451-60, bibl. 5, and 520-37, bibl. 9.
I. *Relative toxicity of various chemicals to four annual weeds.* The four weeds were *Thlaspi arvense, Brassica arvensis, Chenopodium album* and *Avena fatua*. No evidence was forthcoming of any definite specific susceptibility of a given species to a given substance. Some 76 chemicals were tested. II. *Factors affecting estimation of toxicity of leaf sprays.* The greater the volume of the spray the smaller is found to be the proportion of spray retained by the plant, which, however, increases with increased concentration of the spray material. Leaf sprays will therefore be most effective if the minimum volume of solution required for coverage is used at an appropriate concentration. III. *Relative toxicity of several chemicals to perennials under field conditions.* The effective chemicals can be classified into 3 groups according to their toxicity. (1) Sodium chlorate, (2) barium chlorate and arsenic pentoxide, (3) ammonium thiocyanate and sodium arsenite. The relative toxicity of these three groups judged by the certain lethal dose appears to be about 1 : 1·5 : 2. IV. *Relative toxicities and loci of absorption of selected chemicals applied to perennials.* The permanent effect of a treatment appears to be due almost entirely to the action of the chemical in the soil and the ineffectiveness of certain chemicals can be attributed to their rapid detoxication by the soil. V. *Relative toxicity of selected chemicals to plants grown in culture*

solution, and the use of relative growth rate as a criterion of toxicity. Although substances found to be highly toxic to animals as a spray are also found to be very toxic in culture solutions, the results with the two methods do not agree so far as the less poisonous chemicals are concerned.

462. BECKLEY, V. A. 632.951

Pyrethrum in Kenya.

Bull. imp. Inst., Lond., 1938, **36** : 31-44, bibl. 7.

Although the industry is only 5 years old Kenya pyrethrum is now established on the market and with a good reputation. This rapid progress is attributed in great part to the close co-operation between planters and the Department of Agriculture. Cultural and other notes of general interest include the following :—Pyrethrum (*Chrysanthemum cinerariaefolium*) requires a deep, well-drained soil, it is intolerant of too rich or even slightly water-logged soils. When required in great quantity plants still have to be raised from seed. Nevertheless the plant is easily raised from cuttings or division and the life of the plantation is not shortened thereby—in spite of the contrary opinion held in other pyrethrum growing countries. The vegetatively propagated plants are altogether easier to handle than seedlings and flower sooner. In Kenya the plant is self-sterile so that too rigorous a selection must not be practised, another reason against stringent selection being the variability of pyrethrin content between strains which show no outward sign of difference. The theoretically optimum time for picking is when the last florets are about to open. This is impossible commercially. In Kenya, where the flowering period is continuous for 10 months, a plant will bear flowers in all stages of development. Various adjustments of picking periods and methods are adopted to secure a good average of mature flowers and the length between the former is largely dependent on the climatic conditions associated with increasing altitude, thus at 6,000 ft in warm weather opening may take 9 days, whereas at 9,500 ft in cool weather it may take 3 weeks. The daily task for an average picker is 30 lb. The annual yield varies with altitude from 4 cwt per acre at 5,500 ft to 10-15 cwt at 9,500 ft Much remains to be learned about the response of the plant to climate in growth, flowering and pyrethrin content. Just before passing into a resting season with the dry weather the plants are cut back, originally to remove dry flower stalks which interfere with picking, but now also because a definite degree of pruning appears necessary to maintain the plants in good production. Pyrethrin content appears to diminish as the flush ages and probably with age of plant also, but evidence at present is contradictory. At present the profitable life of a plantation, usually 4-6 years, is only terminated by depression of yield through weed growth. Since in drying a fresh flower loses 75% of its weight and the climate is often moist, artificial drying is necessary and a suitable dryer capable of local construction has been evolved. The principle of this is an upward draught of air heated by passing over a flue system, which is forced through a series of trays containing the flowers. Attention to certain details which are described ensures in this dryer a very attractive sample with the natural colour of the flowers unaffected. Methods of grading, sampling and baling are briefly described.

463. JONES, H. A. 632.951.1 : 581.192

Determination of rotenone in derris and cubé-crystallization from extracts.

Industr. engng Chem. (*anal. Ed.*), 1937, **9** : 206-10, bibl. 6.

Details are given of a modified procedure for the crystallization of rotenone-carbon tetrachloride solvate from extracts of derris and cubé roots, which is said to improve in speed and accuracy on older methods.

464. SCHONBERG, S. 632.951.1 : 581.192

Détermination colorimétrique de la roténone.* (**Colorimetric determination of rotenone.**)

Publ. Chim. et. Industr. **133**, 1937 (?), 6 pp., bibl. 12.

The colorimetric method of determining rotenone is said to be rapid, practical and accurate. It takes 2 hours at most and the results agree very well with those obtained by testing the substance concerned on actual insects. The process is here described.

* Paper presented at the 17th Congrés de Chimie industrielle, Paris, 1937.

465. DELASSUS, —., AND LAFFOND, —. 632.951 : 632.78 : 634.8
Les poudres insecticides à base de rotenone dans la lutte contre l'eudemis.
(The use of insecticidal powders based on rotenone for the control of polychrosis (*Polychrosis botrana*).)
C.R. Acad. Agric. Fr., 1937, **23** : 181-9.
Trials in Algerian vineyards indicate the desirability and efficacy of using powders containing rotenone for controlling the third generation of the *Polychrosis botrana* grape moth in preference to arsenical sprays.

466. VINSON, C. G. 632.951.23
Spray residue work in Missouri.
Bull. Mo. agric. Exp. Sta. **382**, 1937, pp. 15.
Factors affecting ease of removal are the use of Kolofog or oils in the sprays which make removal more difficult and the use of lime in the sprays which make it easier. Both flotation and flood type washers are used and have proved efficient. Notes are given on the amount of HCl necessary and the temperatures and exposures desirable under different circumstances.

467. Attention is also drawn to the following articles :—
HARTZELL, F. Z., AND MOORE, J. B. 632.752 : 634.11
Control of oyster shell scale on apple (*Lepidosaphes ulmi* L.) by means of tar oils, tar lubricating oils, and lubricating oils containing dinitro-o-cyclohexyl-phenol. *J. econ. Ent.*, 1937, **30** : 651-5, bibl. 1.
A comparison of effects.

FENTON, F. A., AND MAXWELL, J. M. 632.76 : 634.11
Flat headed apple tree borer in Oklahoma (*Chrysobothris femorata*).
J. econ. Ent., 1937, **30** : 748-50.
Notes on life history.

FROST, S. W. 634.25-2.951.8
Tests with summer-oil emulsions on peach.
J. econ. Ent., 1937, **30** : 658-63, bibl. 1.
Care is necessary to prevent sulphur injury.

WADE, C. W. 632.8 : 634.25
Peach mosaic disease in Colorado. *J. econ. Ent.*, 1937, **30** : 902-4, bibl. 1.
Note of incidence 1935-37.

MCLEAN, H. C., AND WEBER, A. L. 634.23-2.951.23
Spray residue removal from cherries. *J. econ. Ent.*, 1937, **30** : 777-9.
A solution of 1% by weight HCl used.

THOMAS, W. A,, AND REED, L. B. 634.23-2.728
The field cricket as a pest of strawberries and its control (*Gryllus assimilis*).
J. econ. Ent., 1937, **30** : 137-40.
Poisoned baits used as control.

ANDERSON, L. D., AND WALKER, H. G. 634.75-2.76
Dusting to control strawberry weevil in Virginia (*Anthonomus signatus*).
J. econ. Ent., 1937, **30** : 437-8.
Sulphur-lead arsenate (5 : 1) and lime-lead arsenate (5 : 1) most successful, followed by sulphur-derris (·75% rotenone).

HOERNER, J. L. 634.725-2.78
A new gooseberry pest (*Stretchia plusiaeformis* Hy.).
J. econ. Ent., 1937, **30** : 900-2.
Poisoned bran and lead arsenate used to control.

BECKWITH, C. S., AND DOEHLERT, C. A. 632.77 : 634.736
Control of *Rhagoletis pomonella* Walsh in cultivated blueberry fields.
J. econ. Ent., 1937, **30** : 294-7, bibl. 3.
Dusting with derris from aeroplane or autogiro.

NICKELS, C. B. 634.52
Experiments to control pecan nut casebearer in Texas, 1936 (*Acrobasis caryae* Grote). *J. econ. Ent.*, 1937, **30** : 761-3.
Control lead arsenate or nicotine combinations.

HARMAN, S. W., AND REED, T. W. 632.78 : 632.951.23
Codlin moth control with lead arsenate substitutes.
J. econ. Ent., 1937, **30** : 82-6.
Calcium arsenate and certain of the fixed nicotine sprays have met with most success in N. York State.

HARMAN, S. W. 632.78 : 632.951.23
Stickers and spreaders used in lead arsenate sprays for codling moth control.
J. econ. Ent., 1937, **30** : 404-7.
Soybean flour gave considerable success.

DOBROSCKY, I. D. 632.78
Orchard experiments with natural cryolite for codling moth control.
J. econ. Ent., 1937, **30** : 656-8.
Proved to be effective against codling.

FROST, S. W. 632.78
Tests on baits for oriental fruit moths, 1936 (*Grapholitha molesta* Busck).
J. econ. Ent., 1937, **30** : 693-5.
Baits varied in usefulness according to season.

VEGETABLE GROWING, FIBRES, STIMULANTS.

468. DENMARK, ROYAL AGRICULTURAL SOCIETY SEED COMMITTEE. 631.531 : 635.1/7
Some prominent Danish varieties and strains of agricultural and horticultural plants. 1937.
Publication (in English) *of the Kongelige Danske Landhuusholdnings Selkskab.* 1937, pp. 7.
The list given contains the names of the most noteworthy Danish varieties and strains of which samples of commercial seed may be had for experimental purposes abroad on application to the Society at Rolighedsvej 26, Copenhagen V, either free or by covering expenses in the case of large samples. The horticultural strains or varieties offered are :—3 white cabbage, 3 red cabbage, 4 cauliflower, 1 brussels sprouts, 1 spinach, and 3 carrot varieties.

469. VOSS, J. 631.544 : 631.523
Erfahrungen mit der Anzucht landwirtschaftlicher Kulturpflanzen im Treibhaus. (**Breeding of agricultural plants in the glasshouse.**)
Züchter, 1938, **10** : 95-100, bibl. 11.
Studies carried out for many years at the Reich Biological Institute of Agriculture and Forestry, Berlin-Dahlem, are reviewed here. Among horticultural plants to which particular attention is being paid are *Pisum arvense*, *Pisum sativum*, *Vicia Faba*, *Lupinus luteus*, *L. albus*, *L. angustifolius*, turnip and sugar beet.

470. ESBJERG, N. 631.8 : 635.1/7 + 634.11
Forsøg med gødskning af køkkenurter samt af enkelte traearter. II. (**Fertilizers for market garden crops and a few species of young trees.**) [English summary 3 pp.]
Tidsskr. Planteavl, 1937, **42** : 357-478, being *Beretning* **309**, bibl. 122.
This is a detailed report of trials described already *Ibidem* 1929, 35 : 325-89 being *Beretning* 226, and *Ibidem* 1936, 41 : 671-4 being *Meddelelse* 247 (*H.A.*, 7 : 686). The information is tabulated and explanations are given in English. Crops concerned include red beet, parsley, carrots, onions, shallots, leeks, early cabbage, brussels sprouts, red cabbage, potatoes, celeriac, tomatoes, cucumbers and young apple trees.

471. SMITH, E. G. L. 635.25
The onion and its allies.
Bull. Dep. Agric. S. Afr. **174** (Extension series **14**), 1937, pp. 21.
In this paper the essential points in cultivating onions and allied plants in the Union of South Africa are discussed. Notes are given on seed-tests, sowing, soils and manures, transplanting, watering, mulching, harvesting and the choice of varieties.

472. WESSELS, P. H., AND THOMPSON, H. C. 635.31 : 631.8
Asparagus fertilizer experiment on Long Island.
Bull. Cornell agric. Exp. Sta. **678**, 1937, pp. 16.
Experiments were carried on for nine years at the Long Island Vegetable Research Farm near Riverhead. The soil was a sassafras silt loam and each treatment was repeated on five plots. The results may be summarized as follows :—Nitrogen produced a greater increase in yield than any other element. Nitrogen applied at the rate of 50 lb. to the acre annually produced practically the same yield as at 100 lb. Phosphorus applied as 16% superphosphate at the rate of 128 lb. of phosphoric acid to the acre produced a large increase in yield as compared with no phosphorus and with 64 lb. of phosphoric acid. Potash applied as muriate at a rate to supply 80 lb. of K_2O to the acre markedly increased the yield over no potash. The muriate of potash was found to be superior to sulphate. 20 tons of manure plus 128 lb. of phosphoric acid to the acre produced a considerably larger yield than the best fertilizer treatment, but the use of manure was found to be uneconomic by reason of its high cost.

473. ANON. 632.48 : 635.32
La ramulariose de l'artichaut (*Ramularia Cynarae* Sacc.). (***Ramularia* of artichoke.**)
Memento Déf. Vég. Rabat, **40**, 1937, pp. 3.
Ramularia is said to be a very common disease on artichoke plantations in Morocco. Symptoms of the disease are described here, and it is shown how it originates and develops. The nature and the extent of damage caused are discussed briefly and control measures are recommended.

474. ANON. 632.48 : 635.32
L'anthracnose de l'artichaut, *Ascochyta hortorum* (Speg.) Smith. (**Artichoke anthracnose.**)
Memento Déf. Vég. Rabat, **39**, 1937, pp. 4.
Anthracnose is said very often to cause serious losses to artichoke planters in Morocco. A description is given here of the parasite, the course of the disease and the nature and the extent of damage it may cause. Control measures are discussed.

475. ANON. 632.4 : 635.32
Le blanc de l'artichaut. (***Leveillula taurica* Arnaud of artichoke.**)
Memento Déf. Vég. Rabat, **45**, 1937, pp. 4.
A disease, *Leveillula taurica*, affecting various vegetables and ornamentals in the Moroccan coastal area, and causing particular damage to artichokes, is described here. Symptoms, course of development and spread of the disease are discussed, and instructions for its control are given.

476. BREMER, A. H. 635.34
Chinesischer Kohl oder Selleriekohl (*Brassica pekinensis* Rubr.),eine Langtagpflanze. II. (**Chinese cabbage (?) a long day plant. II.**)
Gartenbauwiss., 1938, **11** : 473-82.

Part I of this article appeared in *Gartenbauwiss.*, 1935, 9 : 325-30, *H.A.*, 5 : 245. The Chinese cabbage can be used for salad or as an ordinary green vegetable for cooking. It is a long day plant, which is unsuitable for field cultivation during long-light periods of the year. It is said to be most suitable for early forcing under glass. A description is given of appropriate treatment from the time of sowing to cutting under the conditions at 60-64° northern latitude. The varieties Pe-Tsai (Amelioré) and Wong Bok are said to be particularly good for forcing. A Pe-Tsai plant will produce under glass 80-100 g. 25-30 days after planting out, while Wong Bok is said to produce a crop of 12-13,000 kg. per dekar [or more than 40 tons per acre.—ED.] in a period of 80-90 days.

477. WASEWITZ, H. 635.5 : 632.41
Beiträge zur Biologie und Bekämpfung der durch *Sclerotinia minor* Jagg. verursachten Salatfäule. (**Notes on the biology and the control of lettuce rot caused by *Sclerotinia minor* Jagg.**)
Angew. Bot., 1938, **20** : 70-118, bibl. 24.

In 1935 and 1936 both field and laboratory trials were made by the author on the control of lettuce rot, a disease which yearly causes serious damage to crops in different parts of Germany. A full description of the fungus (*Sclerotinia minor* Jagg.) is given and control measures are discussed in detail. The most effective control is attained by passing steam through the soil. Two different steaming methods are described here. As the result of his experiments the author recommends the following fungicides for chemical control :—2% and 3% solutions of formalin, 0·250 and 0·500% solutions of uspulun and dry uspulun 40 g. per 1 square metre. For light soils, when the fungus is not very active, application of tutan solution at a strength of 0·250% is recommended, and for glasshouse practice 0·250% solution of fusariol. Hot-beds and open-air beds may be treated with dry uspulun, Sch. 1148 (=brassikol), Sch. 1150 and Sch. 1167. Of the chemical solutions 10 litres should be applied to 1 square metre. Useful details including costs of various control methods are given.

478. BEATTIE, J. H., AND DOOLITTLE, S. P. 633.842
Production of peppers.
Leafl. U.S. Dep. Agric. **140**, 1937, pp. 4.
THOMPSON, R. C. 635.62
Production of pumpkins and squashes.
Leafl. U.S. Dep. Agric. **141**, 1937, pp. 8.

The essential points in the cultivation of peppers, pumpkins and squashes are discussed, notes being given on climatic and soil requirements, insects and diseases, storage and marketing.

479. BEATTIE, W. R. 635.54+635.55
Production of chicory and endive.
Leafl. U.S. Dep. Agric. **133**, 1937, pp. 6.

In this leaflet the essential points in the cultivation of chicory, *Cichorium Intybus*, and endive *Cichorium Endivia*, are discussed. Notes are given on the forcing of chicory and blanching of endives.

480. WARINGTON, K. 635.13 : 546.27
Boron in agriculture.*
Nature, 1937, **140** : 1016.

It has been established at Rothamsted that the carrot should be added to the growing list of economic plants for which boron is essential, though in this case probably in relatively very small quantities.

* See also 396-400.

481. ANON. 632.41 : 635.1/7
Le mildiou des Composées (*Bremia Lactucae* Regel). (**Mildew of *Compositae* caused by *Bremia Lactucae* Regel.**)
Memento Déf. Vég. Rabat, **44**, 1937, pp. 4.
A description is given here of *Bremia Lactucae* Regel, a parasite attacking vegetables belonging to the *Compositae*, and particularly the artichoke, chicory, lettuce and cardoon. The cause, symptoms and the spread of the disease are discussed as well as its control by means of copper sprays and by destroying affected plants by fire.

482. ANON. 632.41 : 635.1/7
La sclérotiniose des plantes maraichères. (***Sclerotinia libertiana* Fuck. in market garden plants.**)
Memento Déf. Vég. Rabat, **43**, 1937, pp. 6.
Sclerotinia libertiana attacks a great number of vegetables, hemp and also, though not so frequently, plums, almonds, figs and citrus. In this paper are described symptoms, spread and development of the disease, and measures for its control are discussed.

483. PORTER, D. R., AND MACGILLIVRAY, J. H. 635.64
The production of tomatoes in California.
Circ. Calif. agric. Ext. Serv. **104,*** **1937**, pp. 61.
This circular contains the essential points on the cultivation of tomatoes in California including notes on cropping systems, manuring, irrigation, staking and pruning, unsatisfactory fruit setting, harvesting, pests and diseases, the choice of varieties and disease-control.

484. KORTCHENYUK, Y. T. 635.64-1.523
The influence of the time of seed collection on tomato yield. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 4, pp. 42-3.
An account is given of the trials made with tomatoes in 1935, 1936 and 1937 at the Mayak plant breeding station. The following conclusions were reached :—The seed of tomatoes from the first pick has the highest absolute weight. The seed obtained from succeeding collections of tomatoes has a lower absolute weight. It was, moreover, found that plants raised from this first pick seed gave higher yields and were the less susceptible to disease than plants from later picked seed.

485. WHITE, H. L. 635.64 : 631.84+631.83
Observations of the effect of nitrogen and potassium on the fruiting of the tomato.
Ann. appl. Biol., 1938, **25** : 20-49, bibl. 21.
The experiments were carried out at the Research Station, Cheshunt. Nitrogen starvation reduced the number of flower buds formed, the percentage that opened and the mean numbers of fruit per truss. Nitrogen deficiency retarded the rate of development of the successive lower trusses while potassium deficiency increased it. Growth was retarded by deficiency in either. Maturation between opening of blossom and ripening of fruit is lengthened by potassium starvation and by severe nitrogen starvation and shortened by moderate nitrogen starvation. The mid-season check which all tomato plants undergo is attributed to competition for nutrient supply between the fruits and vegetative parts of the plant and is accentuated by nitrogen and potassium starvation. The reasons for the fruiting and foliage symptoms of potassium starved plants are discussed. The observed effects of potassium deficiency on fruiting, namely acceleration of development of the flower trusses, failure of pollination and prolongation of the maturation period, are those also associated with carbohydrate deficiency relative to nitrogen supply.

* Superseding *Circ.* 66.

486. MITCHELL, J. W. 635.64 : 612.014.44
Responses by tomato plants to artificial illumination.
Bot. Gaz., 1937, **99** : 412-19, bibl. 9.
When tomato plants were supplied with equal intensities of total radiant energy by means of a carbon arc and an incandescent lamp, those illuminated by the arc grew less in height and synthesized more than twice as much solid matter and about four times as much acid hydrolyzable materials and sugars during two weeks than the plants under the incandescent lamp. Given equal incident energy at the leaf surfaces, on a basis of electrical consumption the arc was approximately 53% more efficient in stimulating the production of dry matter than the incandescent lamp : possibly the arc radiated a greater intensity of those wave lengths which are known to accelerate photosynthesis. When light from the two sources was balanced by means of a photronic cell, the plants synthesized more nearly the same amount of solid matter.

487. ANON. 635.64 : 632.19
Le desséchement du sommet des tomates. (**Drying up in tomato fruits.**)
Memento Déf. Vég. Rabat, **37**, 1937, pp. 4.
The cause and symptoms of the drying up of tomato fruits as well as the nature and extent of this disease are described. Owing to the physiological nature of the disease preventive measures only are said to be possible. These are discussed here briefly.

488. BEST, R. J. 633.71-2.8
The quantitative estimation of relative concentration of the viruses of ordinary and yellow tobacco mosaics and of tomato spotted wilt by the primary lesion method.
Reprinted from *Aust. J. exp. Biol. med. Sci.*, 1937, **15** : 65-79, bibl. 13.
and
BEST, R. J. 635.64-2.8
On the presence of an " oxidase " in the juice expressed from tomato plants infected with the virus of tomato spotted wilt.
Ibidem, pp. 191-9, bibl. 8.
Studies are described on the viruses of ordinary and yellow tobacco mosaics and of tomato spotted wilt.

489. BLOOD, H. L. 634.64-2.3-1.631.17
A possible acid seed soak for the control of bacterial canker of the tomato.
Science, 1937, **86** : 199-200.
Preliminary tests indicate that acetic acid alone or in combination may offer a safe and effective tomato seed soak for the control of bacterial canker (*Aplanobacter michiganense* E.F.S.). Further trials are in progress to determine optimum concentrations, etc.

490. ANON. 635.64 : 632.48
La septoriose de la tomate. (***Septoria Lycopersici* Speg. in tomato.**)
Memento Déf. Vég. Rabat, **38**, 1937, pp. 7.
A description is given of the parasite (*Septoria Lycopersici* Speg.) and the symptoms and spread of the disease are described. The nature and extent of damage are discussed briefly. Control measures are dealt with at some length.

491. BAILEY, S. F. 632.73 : 635.651
The bean thrips.
Bull. Calif. agric. Exp. Sta. **609**, 1937, pp. 36, bibl. 39.
Experimental work based on a detailed study of the biology of the bean thrips, *Hercothrips fasciatus* (Perg.), made in 1929-32, has been conducted during the past four years. The results

are reported here together with additional information on the distribution and ecology of the insect. This is an attempt to bring together under one cover all the pertinent facts concerning the bean thrips.

492. Wager, V. A. 635.652 : 632.3
Bacterial wilt and blight of French beans.
Sci. Bull. Dep. Agric. S. Afr. **149** (Plant Industry series **14**), 1936, pp. 19, bibl. 24.
The organism mainly responsible for bacterial wilt and blight of French beans in the Transvaal is *Phytomonas Medicaginis* var. *phaseolicola*. A description is given here of infection experiments made with French bean stems, leaves and seeds as well as soil infection trials carried out in South Africa. Control measures are discussed and resistant varieties named.

493. Anon. 632.3 : 635.656
La bactériose du pois. (***Pseudomonas Pisi* Sackett of peas.**)
Memento Déf. Vég. Rabat, **46**, 1937, pp. 5.
Nature, cause, development and spread of the pea disease, caused by *Pseudomonas Pisi* Sackett, are discussed and control measures are described.

494. Anon. 632.4 : 635.656
La mélanose du pois. (***Mycosphaerella pinodes* (Bk. et Bl.) Stone of peas.**)
Memento Déf. Vég. Rabat, **48**, 1937, pp. 7.
A description is given of *Mycosphaerella pinodes* (Bk. et Bl.) Stone. The parasite, which is stated to cause great damage to peas in North America, was isolated from plants cultivated in Morocco and was closely studied. Control measures are discussed.

495. Schmalfuss, K. 631.83 : 633.52
Über den Einfluss des Kaliums und der Kalisalzanionen auf Ausbildung der Faserzellen des Leins. (**On the influence of potassium and the anions of the potash salts on the development of the fibre cells of flax.**)
Ernähr. Pfl., 1938, **34** : 100-3, bibl. 4.
In 1935 pot experiments were carried out at the Institute of Plant Nutrition and Soil Biology of Berlin University, in which the development of flax plants was observed in Dahlem soil, lacking potash, to which potash salts had been applied in increasing amounts. To some pots potash was applied in the form of sulphate, in others as muriate of potash. In other trials the nitrogen of the basal dressing was applied as ammonium sulphate or muriate according to whether sulphate or muriate of potash was used. Experimental data, showing the yields, average height and the length and diameter of stalk of plants are tabulated, and microphotos of fibre cells are given. Potassium-ion was found to affect the fibre cells in such a way as to produce a higher degree of succulence of the cells. In this connexion considerable importance is attached to the antagonism existing between the action of SO_4 and Cl ions.

496. Beaumont, A. B., and Snell, M. E. 633.71-1.84
Nitrogenous fertilizers for growing tobacco.
Bull. Mass. agric. Exp. Sta. **346**, 1937, pp. 15, bibl. 9.
The tobacco in question was the Havannah seed variety. Nitrogen was applied at the rate of 61·8, 123·5, 164·7 and 205·9 lb. per acre. The highest yield was produced from the 205·9 lb. plot, but the highest grade index from the 164·7 lb. plot. The crop index, the product of yield and the grade index, was also highest for the 164·7 lb. plot. Half the nitrogen was given as cotton seed meal, the rest as nitrate of soda, sulphate of ammonia, calcium cyanide or urea. Nitrate of soda gave the best results as measured by crop index. Differences in results due to altering the organic : inorganic nitrogen ratio from 1 : 7 to 1 : 1 were insignificant. Broadcast application of fertilizer gave better results, viewing the whole 5 years of the experiments, than application in bands near plants at the time of setting. The amount and distribution of rainfall

during the growing season was found to have considerable influence on yield and grade. For best results a comparatively high level of nitrates must be maintained in the soil during the most rapid vegetative growth. These trials indicate that comparatively large amounts of nitrogen should be applied to achieve high yield and quality and that no more than half and probably as little as a quarter of the nitrogen need come from an organic source under conditions similar to those of the trial.

FLOWER GROWING.*

497. TAYLOR, H. V. 635.9
The flower industry today.
Sci. Hort., 1938, **6** : 19-30.

The flower industry of Great Britain is reviewed and the enormous expansion in the home industry since tariffs on foreign grown flowers were imposed is noted. The imposition of tariffs caused the importation of foreign flowers to fall from 1 million pounds sterling in 1931 to about ½ million in 1936. Most of the home-grown flowers are grown under glass. Hertfordshire and Kent are the counties with rose industries, carnations are important in Sussex, Kent, Hampshire, Surrey and Middlesex ; chrysanthemums are universally grown, but in the glasshouse industry of the Lee Valley they are not so widely planted as might be expected. The developments in the cultivation of the most popular varieties are traced and it is remarked how methods of treatment have completely changed within recent years, especially in regard to chrysanthemums, carnations and roses.

498. DUTTON, A. F. 635.9
Experiences of forty years of flower-growing.
Sci. Hort., 1938, **6** : 54-7.

This paper is largely reminiscent and is interesting as showing the great changes that have taken place in methods of commercial flower cultivation during the past 40 years. It deals with the beginnings of the commercial cultivation of what were known as American perpetual flowering carnations of which the author was the pioneer. He was also the first to pack the flowers in singles instead of bunches. To-day more glass is devoted to carnations than any other flower crop. The great increase in commercial flower production owes much to the advent of the motor lorry. A note is given of outdoor flowering plants suitable for growing on spare land.

499. MONRO, G. 635.9 : 658.7/8
Flower marketing from the salesman's point of view.
Sci. Hort., 1938, **6** : 150-3.
STEVENS, H.
Flower marketing and the purchaser.
Ibidem, pp. 154-9.

The first paper discusses condition of bloom, the need for regularity of supply to maintain public interest—since after a shortage the public does not readily start buying again—and the need for proper packing and dependable grading, since much wholesale buying has to be by sample. The second paper deals with the preferences of the retail customer, the continual search by the retailer for something new to stimulate sales, and the beneficial effect on the flower trade of the extension of central heating of dwelling-houses which causes rapid wilting of the flowers. The author explains that much of this wilting could be avoided if the flowers were placed in the cool at night. The tendency to standardization is deplored and the subject of the barrow trade's competition with rate paying shops is discussed.

500. LADDS, T. W. 635.965
The commercial production of pot plants.
Sci. Hort., 1938, **6** : 58-66.

There is still a sale for decorative pot plants in flower and the paper gives notes on growing, amongst others, chrysanthemums, marguerites, fuchsias, heliotrope, salvias, hydrangeas,

* See also 361, 362, 522.

geraniums and heaths and full instructions on the general conduct of a pot plant nursery. In potting the author does not believe in the ramming so often advocated, contending that it blocks the aeration of the soil. Firmness of potting is necessary, but in repotting to a larger pot the new outer soil in the larger pot must be firmer than the ball of soil on the plant, otherwise the centre will dry out, probably unnoticed, and failure will result. In watering the soil must be wetted throughout. Splash watering encourages surface roots and a consequent liability to rapid drying out. Cold grown plants need much ventilation particularly in wet weather; in heated houses the air is kept moving sufficiently and much ventilation only reduces the temperature. In manuring great importance is attached to a fair proportion of potash in all manures used in potting soil. Notes are given on pests and diseases and on soil sterilization.

501. WILSON, G. F. 635.9 : 632.6/7
Pests of commercial ornamental plants.
Sci. Hort., 1938, **6** : 102-16, bibl. 3.

The more obnoxious pests and their control are briefly described and there is an appendix (pp. 112-6) in which the pests found on a great number of ornamental plants are tabulated under the headings host plant, scientific name of pest, common name of pest.

502. CERES. 631.588.1 : 631.544 : 635.936.69
Carnation culture.
Rur. Electrif., 1938, **13** : 102-3.

The methods of commercial culture of carnations under glass are briefly described with the object of showing how electricity can be used to increase efficiency.

503. STEVENSON, J. B. 635.936.69
Growing carnations for market.
Sci. Hort., 1938, **6** : 48-53.

This paper is provided by a practical and successful grower who as he says has " set down everything as we do it " and has produced a very clear and useful treatise as a result. He is an advocate of generous soil treatment and holds that no trouble and reasonable expense should be spared if it results in better quality. The plants in this nursery are grown in single houses 200 ft. $\times 30\frac{1}{2}$ ft. and are planted direct in the ground, but the treatment of pot-grown plants is also described. Some interesting figures are given. A house containing 7,000 plants of ordinary market varieties should give 32,000 dozen blooms over a period of 26 months, the profitable flowering life of a plant. This represents $4\frac{1}{2}$ dozen blooms per plant or 70 dozen blooms per square yard of bed, equalling 1 lb. weight of flowers per square yard per month. With an average price of 1s. 6d. per dozen the gross takings would amount to 3s. 10d. per square yard of bed per month or a total of £5 10s. per square yard per planting. The author does not give production costs but remarks that, if he did, the business would look less like a gold mine. The paper concludes with a list of varieties.

504. WHITE, H. L. 635.936.69 : 632.4
Stem rot and wilt of the perpetual flowering carnation.
Sci. Hort., 1938, **6** : 86-92, bibl. 6.
BROWN, W.
Stem rot and wilt of the perpetual flowering carnation.
Ibidem, pp. 92-6.

Points of practical interest arising out of the work on the stem rot and wilt diseases of perpetual flowering carnations carried out at Cheshunt Research Station are summarized.

505. SPEYER, E. R. 635.936.69 : 632.6/7
Pests of the carnation and their control.
Sci. Hort., 1938, **6** : 72-85, bibl. 43.

An account of the life history and instructions for control are given for the following pests of indoor carnations—red spider mite, tortrix, tomato moth, aphis, leaf miner, thrips and several minor pests.

506. BEWLEY, W. F. 635.937.34-632.4
Recent work on rose diseases.
Sci. Hort., 1938, **6** : 97-101.
The diseases treated of in this paper are graft canker, rose rust, black spot and mildew. Their appearance and symptoms are described and methods of control are suggested. Certain investigations carried out on these diseases at Cheshunt are briefly reported.

507. WENZL, H. 632.482 : 635.937.34
Botrytis cinerea als Erreger einer Fleckenkrankheit der Knospen und Blüten der Rose (" Blütenfeuer "). (***Botrytis cinerea* as the agent of a spot disease of buds and flowers on roses.**)
Gartenbauwiss., 1938, **11** : 462-71, bibl. 17 lines.
Investigations were made into the cause of the *Botrytis* disease on roses at the Institute of Plant Protection, Vienna. The author reviews the literature on this subject and describes his own trials in full. In his summary he states that *Botrytis* does not only occur on roses after they have been previously damaged, e.g. as a result of unfavourable weather conditions, and not only as a saprophyte or when the plant is weakened owing to some other cause, but also that it can appear as a true parasite.

508. CROSS, P. E. 635.939.98
The cultivation of early flowering chrysanthemums.
Sci. Hort., 1938, **6** : 31-8.
LUXFORD, K.
The cultivation of late flowering chrysanthemums.
Sci. Hort., 1938, **6** : 39-47.
These papers describe the cultivation of chrysanthemums for market flowers. The early flowering chrysanthemum grown out of doors gives the biggest gross return per acre (£1,000-£2,000) of any other open-ground crop. However, as the author proceeds to point out, the running expenses and capital expenditure necessary to produce first class bloom are very heavy and it is only the first class bloom that pays. The first paper is concerned with disbudded bloom which always finds a market, whereas spray chrysanthemums, though less trouble, are not always saleable. The second paper deals mainly with pot grown, late chrysanthemums which are brought into flower under glass, but there is also a short section on the method of lifting plants from the open ground for flowering under cover. In this connexion it is mentioned that wire pots are becoming very popular. The plants are potted into these in May and plunged in the soil outside and they can be lifted when required without risk of damage to the ball of soil which it is important to maintain on the roots. In each paper lists of varieties are given. Both deal with their subjects very thoroughly and should certainly be read by anyone contemplating this kind of work.

509. HODSON, W. E. H. 635.939.98 : 632.1/8
Diseases and pests of chrysanthemums.
Sci. Hort., 1938, **6** : 67-71.
The common diseases of chrysanthemums are leafy gall, which is bacterial trouble related to crown gall, spotted wilt virus, mildew (*Oidium Chrysanthemi*), rust (*Puccinia Chrysanthemi*), wilt (*Verticillium* sp.), and the main pests are eelworm, capsid, leaf miner, midges and root maggot. The symptoms produced are described and instructions are given for their control.

510. MINISTRY OF AGRICULTURE, LONDON. 632.771 : 635.939.98
The chrysanthemum midge, *Diarthronomyia* sp.
Adv. Leafl. Minist. Agric., Lond., **286**, 1937, pp. 6.
The place of origin of the chrysanthemum midge and the legislation regarding importation of plants are briefly discussed. The symptoms of attack and the habits and life history of the pest

are noted. Control measures including destruction by fire of debris and nicotine spraying are briefly described.

511. Grainger, J. 612.014.44 : 581.145.1 : 635.939.98
Studies upon the time of flowering of plants. I. The relation of nocturnal translocation to time of flowering.
Ann. appl. Biol., 1938, **25** : 1-19, bibl. 8.
Working principally with the late flowering chrysanthemum, a short-day plant, experiments are described which suggest that lateness of flowering is due to delayed nocturnal translocation compared with summer blooming species. In the case of the chrysanthemum transportable carbohydrate did not appear in the leaves during the short summer nights and in the longer nights of spring it was only detectable just before dawn. Thus a 4-hour period of darkness in the middle of the day does not hasten the flowering of a short-day plant as the time is insufficient for translocation to start ; the additional period of darkness must immediately precede and/or succeed the hours of natural darkness. The short-day species have an over-abundance of starch and poor translocation, the long-day plants manufacture starch more slowly and it is steadily removed. A high C/N ratio is presumed to induce flowering ; probably, therefore, the delayed translocation of the late-flowering chrysanthemum prevents the attainment of a suitable ratio until the nightly period of translocation is increased with the lengthening autumn hours of darkness or by artificial darkness in summer. Long-day plants have an effective translocation and readily attain the correct C/N ratio. The importance is stressed of estimating the mobility of carbohydrate rather than only soluble or even total carbohydrate when considering its effect upon the time of flowering.

512. Pussard, R. 632.78 : 633.812
La teigne de la lavande (*Sophronia humerella* Schiff). (***Sophronia humerella*, a lavender moth.**)
C.R. Acad. Agric. Fr., 1937, **23** : 387-95.
Experiments in the Basses Alpes on this serious pest of lavender, *Sophronia humerella*, have shown that the application of sprays during the time that the larvae were eating the terminal leaves of the shoots was successful in controlling this pest and enabling a good crop of flowers to be obtained. Out of 13 sprays one containing the following ingredients proved much the most successful :—White soap 1,000 g., sodium carbonate 80 g., nicotine extract at 500 g. per 1,000 300 c.c., water 100 litres.

513. Kavka, B. 635.939.124 : 631.8
Vliv organických i anorganických příměsí v půde na vzrůst *Azalea indica* hort. (**Influence of organic and inorganic additions to soil on the growth of *Azalea indica* hort.**) [English summary.]
Ann. Acad. tchécosl. Agric., 1937, **12** : 688-703, bibl. 12.
A series of experiments with different soil mixtures and fertilizers was carried out at Průhonice during 1936 and 1937. The results show that *Azalea indica* requires plenty of organic, easily oxidized substances and good soil aeration. Compounds such as soot, which reduce the oxidation, are detrimental, while those which increase it such as $KMnO_4$ and H_2O_2 have a favourable effect. As to acidity the best results have been obtained within pH 5·13 to 6·68. For acidifying sulphates may be used, but chlorides influence the growth unfavourably. $KAl(SO_4)_2$ is most effective, $FeSO_4$ and $Al_2(SO_4)_3$ being less so. Malt sprouts, peat soaked in liquid manure and "Hortus" (a chloride-free complete fertilizer) showed favourable effects. A soil mixture composed of 40% oak leaf mould, 20% shredded peat, 20% muck and 20% sand with an addition of 10 grams $KAl(SO_4)_2$ per kg. mixture is recommended. Calcium is most detrimental when in the form of $CaCO_3$. $CaSO_4$ has no effect and CaO is readily washed out. The effect of calcium is even worse in hard water in the absence of iron compounds. J.S.

514. ZWINGENBERGER, H. 633.88
Zur Kenntnis des Königskerzen-Anbaues. (Gewinnung der "Flores Verbasci"). (**Cultivating *Verbascum* species for the purpose of obtaining "flores verbasci".**)
Angew. Bot., 1938, **20** : 1-61, bibl. 5½ pp.
Studies were made at the Institute of Applied Botany of the Hansa University with the plants of the genus *Verbascum*, the flowers of which are used for medicinal purposes. All the main points in cultivating *Verbascum* species are discussed here at length, notes being given on taxonomy, genetics, seed growing under glass and in the field, as well as pests and diseases, harvesting and storage. The report contains many illustrations and tables. The statement made by Murbeck (lit. cit.) that hybrids between *Verbascum thapsiforme* Schrad. and *Verbascum phlomoides* L. are sterile was found to be incorrect.

515. BÄRNER, J. 631.8 : 668.589.492 + 668.589.98
Abhängigkeit des Gehalts an ätherischem Öl von der Kalium-, Stickstoff- und Phosphordüngung bei Labiaten und Kompositen. (**The effect of fertilizers on essential oil content in *Labiatae* and *Compositae*.**)
Angew. Bot., 1938, **20** : 62-9, bibl. 10.
Fertilizer trials were made with *Artemisia Absinthium*, *Tanacetum vulgare*, *Origanum Majorana* and *Salvia officinalis* at the Reich Biological Institute, Berlin-Dahlem. The following groups of fertilizer were applied :—1. Complete fertilizer. 2. Double dose of potassium. 3. No potassium. 4. Double dose of nitrogen. 5. No nitrogen. 6. Double dose of phosphorus. 7. No phosphorus. All results are tabulated. Well developing plants receiving complete fertilizer were generally found to contain more essential oil than plants receiving other fertilizer treatments. Detailed results are given in each particular case.

516. GREGORY, F. G., AND PEARSE, H. L. 612.014.44 : 581.12
The effect on the behaviour of stomata of alternating periods of light and darkness of short duration.
Ann. Bot., Lond., 1937, **1** : 3-10, bibl. 7.
A study of the effect of alternating periods of light and darkness on the stomatal movement in the leaf of *Pelargonium zonale*. The periods varied from 5 seconds to 2 minutes. Stomatal aperture was recorded automatically by means of the recording resistance porometer. Transition from darkness to alternating light resulted in a partial opening, and transition from full light to alternating light in a partial closure of the stomata. With each duration of alternating light a fairly definite equilibrium position is said to be reached, both when the latter was approached from the fully closed and from the open position of the stomata. At equilibrium a minimum opening is obtained with alternations lasting 45 seconds, both longer and shorter alternations resulting in larger apertures. Records are given of rhythmical variations of the size of the stomata. They include records of stomatal movement in continuous light for 12 hours. The period of pulsation was found to be approximately 15 minutes.

517. PURVIS, O. N. 635.944
Recent Dutch research on the growth and flowering of bulbs. II.* The temperature requirements of tulips and daffodils.
Sci. Hort., 1938, **6** : 160-7, bibl. 18.
Tulips. The structure and annual cycle of the tulip bulb are described and the differences in both from those of the hyacinth are noted. Data from the experiments in storage and forcing temperatures which have been in progress for a number of years at Wageningen and Lisse are briefly recorded and as a result of them certain definite treatments are recommended. *Storage treatment of Darwin tulip bulbs for normal field planting.* After lifting [date not mentioned.—ED.]

* Part I. The temperature requirements of hyacinth. *Ibidem*, 1937, 5 : 127-40, *H.A.*, 7 : 415.

the best storage temperature is 79° F. until 1 September followed by 63° F. for 1 month. Earlier flowering of outdoor plantings can be brought about by storage at 68° F. for 3 weeks followed by 48° F. for 8 weeks. This gives fewer abnormalities than storage at 48° F. throughout. *Treatment of Darwin bulbs for forcing.* Storage treatment at 68° F. for approximately 3 weeks followed by 48°-46° F. for 8 weeks is used for earliest forcing, 5 weeks at 68° F. delays flowering. A surer guide to the length of the first stage is the condition of the growing point. On cutting open a sample of bulbs all should show flower formation in at least one of the following stages :— outer petals, inner petals, outer stamens, inner stamens each distinguishable as a separate growing point. After planting (the brown outer scale should be previously removed or it may interfere with root emergence resulting in the bulbs lifting themselves out of the soils) the bulbs are kept in the dark at 48° F. for 7 to 8 weeks until the leaves just become visible; next at 55° F. until the noses reach a height of $1\frac{1}{4}$ inches (in 2 or 3 weeks) and then at 63° F. until they are $2\frac{1}{2}$ inches high (a further 2 or 3 weeks). At this point the bulbs are brought into the light at a temperature of 73° F. which is reduced to 63° F. when the flower buds begin to colour. The need for precision in controlling storage temperatures for forcing tulips is emphasized by the photographs of the very different results of a variation of only 4°. Varietal requirements do not so far appear to differ greatly. Tulips prepared for early forcing are useless for late forcing. *Daffodils.* The daffodil differs from both hyacinth and tulip in that at lifting time in July every organ of the new flower is present except the trumpet. Thus only extension growth takes place in storage and the temperature requirements are very different from those of bulbs in which organ formation continues during storage. In the daffodil lifting to some extent checks the continuance of flower formation in storage, in the hyacinth it actually initiates it, in the tulip the completion of the leaves has to take place. The most suitable way of dealing with the daffodil for forcing is to lift in mid-July (the normal time), cool immediately to 48° F. and avoid heating at any subsequent time. After planting the boxes are kept in the dark till the flower buds appear, then brought in to the light and forced at 63° F. This treatment will bring many varieties into flower before Christmas. The temperature, however, should be kept below 60° F. for a few days after the bulbs are brought into the forcing house to prevent the occurrence of delayed or defective flowering. The author points out that with all these bulbs, in view of the work still to be done, the planting schedule should not be regarded as final or as covering all the reactions of the whole range of varieties within the species.

518. ADAMSON, R. M. 635.944
Corm behaviour in the gladiolus in relation to season of bloom.
Sci. Agric., 1937, **17** : 733-5.

Late flowering gladiolus cannot be maintained in Alberta owing to a decrease in corm volume not found in the early or mid-season varieties due to the longer period the latter have for corm formation, which occurs in the main after blooming. [" Early " here does not refer to the small-flowered *G. Colvillei* types known in England as early-flowering gladiolus but to early flowering kinds of the large late-flowering hybrids.—ED.]

519. NEWTON, W., HASTINGS, R. J., AND BOSHER, J. E. 635.944 : 632.651.3
The nematode disease of bulbous iris caused by *Ditylenchus dipsaci* (Kühn 1858) Filipjev 1936, and experiments on its control by bulb treatment.
Canad. J. Res., 1937, 15, Sec. C., pp. 175-81, bibl. 5.

Canadian attempts to control the nematode of iris by treatment of the bulb have not so far proved very successful. Treatment of the bulb for 1 hour in November with water at 44° C. resulted in its failure to grow. Treatment of bulbs with cold organic mercury solutions and other solutions increased the yield of bulbs, apparently by reason of the control which they exerted on *Penicillium* sp. and other parasites but not on the nematodes. Fumigation with ethylene dichloride and ethyl acetate injured the bulbs and failed to control the nematodes. Formalin as a fumigant was less injurious, but similarly did not control the nematodes.

520. DE MOL, W. E. 635.944 : 575.24
Teilungsdisharmonie durch niedrige Temperaturen, die Ursache von Modifikationen, Mutationen und anormalen Pollenkörnern. (**Division disharmony due to low temperatures suggested as a cause of modifications, mutations and abnormal pollen grains in hyacinths.**)
Gartenbauwiss., 1938, **11** : 431-56, bibl. 30.

The author has conducted experiments for some years in Holland with several varieties of hyacinth. Detailed information and experimental data are given. In his summary the author puts forward a hypothesis that not only temporary modifications but also mutations result from abnormal conditions during the process of cell-division—such as are now brought about by the cooling and heating processes used to induce early flowering of bulbs. Effects of varying treatments are noted in support of this hypothesis. In these cases the division mechanism of the gene is affected by external conditions in such a way that either delay or an acceleration of the process takes place, resulting in a loss or gain of elementary genes.

521. SMITH, F. F., AND UTTER, L. G. 635.937.9 : 632.73
The iris thrips and its control by hot water, with notes on other treatments.
Circ. U.S. Dep. Agric. **445,** 1937, pp. 12, bibl. 4.

Bregmatothrips iridis is primarily a pest of iris and is stated to be known in 10 of the United States. Foliage and leaf sheaths of many iris types show a rusty or blackened injury, while on Japanese iris flowers bracts and petals also may be injured. The life history of the thrips is described. It is stated that its original home was Europe and not Japan. The thrips cannot be controlled by burning off old foliage during winter or flooding the plants during the growing season, but it can be killed on plants that have been lifted and freed of soil by immersing for 30 minutes in water at 110° F., or on plants in beds by flooding with water maintained at the desired temperature and confined in a cylinder pressed into the ground around the plant. Japanese iris flowers should be treated preferably in the spring. Spring transplanting and treatment proved disastrous to bearded irises, southern types of irises and certain miscellaneous species. Treatments of such types late in the summer or in the autumn were found successful. Preliminary tests with insecticides and fumigants gave promising results.

CITRUS AND SUB-TROPICALS.

522. RICARD, J. H. 91.026 : 634.323 + 635.937.34
Les travaux du " Comité de la rose et de l'oranger au Sahara ". (**The work of the Sahara rose and citrus committee.**)
C.R. Acad. Agric. Fr., 1937, **23** : 881-94.

The committee, whose work is here discussed, originated at a congress held at the El-Goléa oasis in 1930. Its chief object is the promotion of the culture of roses and of citrus trees in the Sahara.
Roses. A certain amount of success has been achieved with the introduction of ordinary ornamental varieties, and in addition tests made of the local roses of El-Goléa have shown that the quality of perfume extracted is good. The quantity is uncertain but Marrakech and Grasse roses have now been introduced for trial and in addition Persian and Bulgarian varieties are available.
Citrus. Among other introductions the most important is that of grapefruit, of which the following varieties have now arrived at El-Goléa :—Duncan, Little River Seedless, Marsh Seedless, Forster, Thomson Royal, Pink Marsh. The most satisfactory method of introducing these trees from California has been in special pots containing the plant in soil weighing all told some 10 kg. and capable of being carried as personal luggage. These have apparently come in the first instance to the Institut national d'Agronomie de la France d'Outre-Mer where they have been acclimatized and multiplied in the garden at Nogent. As a result this Institute is now in a position to deliver a minimum of 100-150 grafted grapefruit trees yearly to French possessions overseas.

It may be noted that attempts are also in progress to introduce other plants to the oases, including apricots, cherries, plums, peaches, loganberries, and the tropical *Annona Cherimola, Casimiroa edulis, Cereus triangularis, Cyperus esculentus*, avocado, etc.

523. OPPENHEIM, J. D. 634.3

The development of cultural practice in the citrus groves of Palestine.

Hadar, 1938, **11** : 41-4.

Some of the problems which have agitated the citrus growers of Palestine during the last ten years are reviewed. A few exist at the present day, the majority have been forgotten not, usually, because they have been solved, but because as the trees grew up the focus of interest shifted and it was found that after all they had never really mattered. A case in point is deep versus shallow ploughing. Deep ploughing, at one time considered essential, gradually, because of its cost, gave way to shallow ploughing with no loss of efficiency. Then new land was ploughed only in late autumn, now it is ploughed all the year round except in the rainy season. With the practical cessation of new planting have gone the problems of what to plant and those connected with the care of young trees. The author regrets that Professor Clark Powell's advice to restrict the planting of grapefruit and increase the varieties of orange was not taken. The best layout for hillside plantations to cope with erosion was a matter of discussion and experiment, not always with the happiest results. The experts also differed over the question of planting distances, some advocating the dense planting of the Arabs with the trees interlacing overhead and the consequent impossibility of pest control and others such distances as 7×7 metres. The optimal distances are still experimentally undecided, but a tradition is gradually being established of 5×5 m. for grapefruit and 4 m. or $4 \cdot 5$ m. square for oranges. The question of the thinning out of densely planted groves is still debated, even though the advantages, including an increased yield, have been amply demonstrated. The value of windbreaks is at last fairly universally acknowledged, though unsuitable, low-growing trees are still sometimes used for the purpose. The best height and season of budding were subjects which often led to acrimony and are only now being scientifically resolved. New planting having now stopped, the question of whether to bud on the stem of yearling stocks or on the branches of older stocks, though still undecided, has lost practical value. Much ink was vainly expended in discussions on the ultimate form to be taken by the trained tree and the best methods to arrive at the selected shape. Ten years later it is impossible to distinguish between the shapes of trees of the rival protagonists or between their yields. Rootstock and pruning questions never aroused much interest ; sour orange for heavy soil and sweet lime for light was the accepted rootstock rule and pruning was confined to the removal of dead wood. Irrigation problems centred round nature of installation, technique of watering and quantity of water needed.

524. HADAR. 634.3

Hadar (Tenth anniversary number), 1938, vol. **11**, No. 1, pp. 66.

This number of the Palestine citrus journal celebrates the 10th anniversary of its first issue by a number of articles showing the development of the citrus industry, citrus research and cultural practice in Palestine during the past decade. [See also separate abstracts in this issue.—ED.] The reader obtains a very clear picture of the present position of the citrus industry in Palestine and of the special problems which it has to solve, if it is to maintain the prominent position which it has so quickly attained.

525. DAWE, M. T. 634.3

The citrus industry and the Government.

Hadar, 1938, **11** : 23-7.

The assistance given by the government to the citrus industry of Palestine during the past ten years is reviewed. Such assistance took the form of improvements in communications by road, rail and at ports, the inauguration and development of the fruit inspection service, invitations to experts from other citrus growing countries to visit Palestine and give advice, in addition to the engagement of competent permanent horticultural officers, the establishment

of regional horticultural experiment stations, investigations into pests and diseases and, until recently, the carrying out of compulsory tree fumigations where necessary, prohibition of the importation of citrus plant material except under strict quarantine, the organization and participation in locust campaigns, the enaction of legislation to check the spread of disease from nurseries to grove, to ensure the issue of trees true to name etc., the subsidizing of private research stations under conditions which ensure the fruits of their investigations being available to all, the establishment of the Citrus Fruit Committee and others on whose recommendations much profitable action has subsequently been taken, participation in Imperial and local exhibitions and fruit shows and the reduction of certain taxation bearing unduly heavily on citrus growers.

526. Yedidyah, S. 634.3-1.541.11
Citrus varieties and rootstocks in Palestine.
Hadar, 1938, **11** : 39-40.

The orange of chief commercial importance in Palestine is the Shamouti or Jaffa. It is mainly budded on to sweet lime, a stock which is susceptible to foot rot and to the so-called " new disease ". Sweet lime stock should not be budded until it is 2 years old and branching. Sour orange, little used with Shamouti, comes into bearing late and is not very prolific. Rough lemon and the Baladi (or local) orange are good stocks as regards yield, though they come into first bearing rather later than sweet lime. Ruby Blood and de Nice are suggested as supplementary crops to the Shamouti likely to gave a good local sale. Washington Navel is proving a success, though not yet an export variety; there are, however, a great number of inferior forms in the country and the sale of budwood from these is practised (owing to the demand for Navels) and is likely to prove very detrimental. The most suitable stock for this orange and for the Valencia is the sour orange, or on light soils, rough lemon ; sweet lime stock should be avoided, the same applies to choice of stocks for grapefruit. The lemon grows well but matures in winter when prices are low. It succeeds on any of the rootstocks commonly used in the country. The Clementine mandarin develops a smaller, later maturing fruit on sour orange than on sweet lime, but the latter makes a weaker tree. The Satsuma is suited best by sweet lime and such mandarins as Avana and Dancy by lime and sour orange.

527. Cabbab, A. C., and Soliven, F. A. 634.3 : 581.192
The proximate physical and chemical composition of twenty-six species of citrus and twelve non-citrus fruits grown in the Philippines.
Philipp. Agric., 1938, **26** : 644-54, bibl. 15.

Twenty-six species of citrus and 12 non-citrus fruits grown in the Philippines were analysed for the average weight of the fruit, amount of refuse, edible portion, seeds, juice ; and for the moisture, ash, protein, total sugars, water soluble sugars, sucrose, pH and titratable acidity of the edible portion. The results are set out in 4 tables.

528. Anon. 634.3-1.67
Underhead system for irrigating citrus trees.
Calif. Citrogr., 1938, **23** : 197, 217.

A method of sprinkler irrigation used by a citrus grower in California is described. The sprinklers which throw square jets (for economy) are fixed one each on 20 ft. lengths of 1 inch steel tubing connected to each other to the number of 3 and to the hydrants of the main permanent pipes (laid 16 feet apart) by ordinary garden hose. The tubing lies on the surface of the ground and can be attached as required to different points along the main. The sprinklers project 6 inches above the ground which suffices to clear the cover crop. The claim is that this system saves much water and labour and can be used on flat, sloping or terraced ground. It is a great deal cheaper than overhead sprinkling. In the same article are photographs and a comment on 4-year-old lemons on sweet orange which are already almost as large and as profitable as adjacent 16-year-old lemons on sour orange.

529. Theron, J. J. 634.3-1.67-1.415.3
Alkali and irrigation studies with citrus trees in the Sundays River Valley.
Publ. Univ. Pretoria, **40** (ser. 1), 1937, pp. 41, bibl. 7.

In spring 1931 an abnormally severe and sudden defoliation of certain citrus varieties was observed in the lower part of the Sundays River Valley. Soil alkali was found to be responsible for the trouble. But the analyses made of the soils of severely affected orchards indicated that the concentration of alkali salts was not sufficiently strong to exert a harmful effect directly on the trees. Their deleterious effect was exerted indirectly through their influence on the soil. Analyses of the irrigation water showed clearly that serious pollution with highly saline seepage water took place in respect of the water supplied to the lower part of the Valley, whereas the purity of the water used in the upper part, where trees had been healthy and normal, was satisfactory. The author concludes that the continued use of the saline water has resulted in the gradual development of a brackish condition in the soils of the lower part of the Valley and as a consequence the water holding capacity, as well as the water supplying power of these soils, was so reduced that the trees had difficulty in obtaining their requirements in respect of moisture, air and food. In such soils the trees are said to be unusually susceptible and the sudden, severe defoliation mentioned above is to be ascribed to a coincidental combination of climatic and soil conditions with which the trees, in this vulnerable state, could not cope. No " toxic " limits of alkali salt concentrations in soils could be found, and the author points out that alkali salts generally exert their injurious effects on the plants only indirectly by the disturbance they create in the physical and chemical structure of the soil, whereby the moisture and air relationships in the soil are deleteriously affected. Soil moisture studies were made in a number of different orchards. The rate of transpiration of an orchard in the Sundays River Valley on a normal non-alkali soil and, in which a fair degree of weed-control was practised, reached a maximum of some 0·12″ per day during December and January and a minimum of approximately 0·02″ during June and July, the water transpired over the entire year amounting to approximately 23 inches. With proper methods of application the irrigation efficiency was found to be about 60% and, allowing for 8·5″ for effective rainfall, the annual requirements of citrus trees in this area are said to lie between 24 and 25 inches. In view of the slight brackishness of the irrigation water in the Valley, the alkali position can be controlled only by the exercise of due care in the amount of water applied. The most effective method of irrigation is stated to be the basin system, and it is recommended in spite of higher management costs. The importance of weed-control is stressed.

530. Daybell, F. 632.111 : 634.3
A pipe line system for filling orchard heaters.
Calif. Citrogr., 1938, **23** : 251.

A description and plan are given for a system of surface pipe lines for the economical and rapid filling of orchard heaters. By this system it is claimed that one man can fill 500-600 heaters in a ten hour day. Briefly a two-inch pipe line leading from the pump is joined at 7-tree intervals by lateral 1-inch pipes running at right angles into the orchard. The laterals are equipped at 4-tree intervals with $\frac{3}{4}$-inch hose bibs screwed directly into Ts in the line at 4-tree intervals. These hose bibs take 100 feet of $\frac{3}{4}$-inch oil-resistant hose tested to 60 lb. capacity and equipped with special spring-type filling nozzles. The diagram shows the path of travel of the hose carrier to heaters placed at 2 tree intervals, a sixty foot length reaching 10 fillers.

531. Uphof, J. C. T. 634.3-2.111
Wissenschaftliche Beobachtungen und Versuche an Agrumen. IX. Der Einfluss von Frost. (**Notes and experiments on citrus varieties. IX. The influence of frost.**)
Gartenbauwiss., 1938, **11** : 391-412.

From 1922 to 1936 frost resistance was studied by the author on a great number of citrus strains, varieties and hybrids in Florida. Most of the conclusions were reached in the severe winter 1934/35, when citrus trees were studied at the Experiment Station of U.S. Department of

Agriculture at Orlando and in a number of privately owned orchards in Central Florida. The actual number of trees on which the trials were based is not stated but would appear to have been adequate. Investigations did not include physiological laboratory tests. Trees that had formed shoots after the second week in February and were injured by frost at that time were not considered in the present study, nor were trees receiving excessive nitrogen, as the author considers such conditions as abnormal. In table 1 frost records are given from 1766 to 1928, the period from 1766 to 1894 being recorded at Jacksonville in the north-eastern part of Florida, and that from 1895 to 1928 at Bartow, near Tampa, Central Florida. In table 2 are given the lowest temperatures occurring in 1934 in different parts of Florida. They are taken from records of the U.S. Weather Bureau. The observations made may be summed up as follows : —Grafted trees were generally found more liable to injury from frost than seedlings. The best way to protect young trees from frost is to heap up the soil round their stems. Ordinary soil from around the tree is used and in Florida this happens to be of a sandy nature with very little humus. In Central Florida orchards they begin earthing up the trees in this way at the end of November and continue to do so until mid-December. To delay longer is dangerous. The stems must be covered well above the union, but not much higher or normal respiration cannot take place. After a few weeks the trees should be examined and the covering made good where necessary. Trees previously damaged by frost should not be subjected to this treatment as rotting is under these circumstances apt to pass from the dead to the sound tissues and the trees often die as a result. The soil must be removed about mid-February or the beginning of March. The smallest frost injury was found to be suffered by the orange varieties Valencia Late, and Hamlin (*Citrus sinensis* Osbeck), then came seedlings, and then grapefruit varieties such as Duncan and Marsh's Seedless (*C. paradisi* Macf.). Pineapple-oranges were found much less resistant to frost than were Valencia Late oranges. *C. aurantifolia* Swingle and *C. Limonia* Osbeck were most severely damaged by the frost while *C. nobilis* Lour. var. *deliciosa* Swingle and *C. sinensis* Osbeck × *C. nobilis* Lour. were also badly injured. Frost resistance also was found to be dependent on physiological conditions and nutrition of the trees. Trees receiving too much nitrogen are reported as having been much more severely injured by frost than trees receiving normal ratios of fertilizers, while trees that had received plenty of potassium notably stood frost best. Rootstocks were found to have a great influence on frost resistance of citrus trees. Thus trees on sour orange, *C. aurantium* L., were considerably hardier than trees on Florida rough lemon, *C. Limonia* Osbeck. Hamlin orange on sour orange was very hardy. Varieties grafted on Cleopatra mandarin also showed considerable frost resistance, but the disadvantage of this rootstock is that the variety worked on it bears smaller fruits than on other rootstocks, Temple mandarin proving an exception to this rule. *Citrus* (*Poncirus*) *trifoliata* stock was found to increase frost resistance greatly, but it is only being used as a rootstock for Satsuma. The severest injuries were generally found to occur on younger trees, those from 1 to 5 years old being injured worse than 6 to 11-year-old trees and these again worse than trees from 11 to 16 years old. After a frost trees must be pruned, preferably on the emergence of new shoots, as it can then be seen where the wood has died. The present paper should be of interest to citrus growers in the districts subject to frosts, as it contains practical observations on frost resistance of a great number of commercial citrus varieties, and on the extent of injury of various strains, varieties and hybrids.

532. PARKER, E. R. 634.323-2.19

Effect of zinc applications on the crop of grapefruit trees affected with mottle-leaf.

Hilgardia, 1937, **11** : 35-53, bibl. 15.

The condition of mottle-leaf has a profoundly deleterious effect on the fruiting behaviour of grapefruit trees. In this paper zinc is shown to be specific for mottle-leaf when applied as a spray at the beginning of blossoming. The effective mixture was 10 lb. $ZnSO_4$, 5 lb. $Ca(OH)_2$, 4 oz. blood albumin spreader per 100 galls. water. The experiments were carried out at Riverside Citrus Experiment Station, California. [A popular article on the same trials appeared in *Calif. Citrogr.*, 1937, **23** : 14 ; *H.A.*, **7** : 979.—ED.]

533. Haas, A. R. C. 634.3-2.19-1.535

Zinc relation in mottle leaf of citrus.

Bot. Gaz., 1936, **98** : 65-86, bibl. 10.

The paper reports (1) the effect of zinc treatment on the disappearance of mottling and on the rooting of mottled cuttings ; (2) sugar content of leafy-twig cuttings of Valencia orange in relation to mottling ; (3) artificial production of mottle-leaf in soil and sand cultures ; (4) relation of zinc to the presence of mottle-leaf in the early stages of growth in solution cultures. Cuttings for rooting were dipped in a mixture consisting of 100 g. $ZnSO_4.7H_2O$, 50 g. $Ca(OH)_2$, a minute amount of blood albumin spreader and 1 litre distilled water. The treatment increased the number of both healthy and mottled Valencia oranges that rooted and increased the rooting of healthy lemon leaves but not of mottled lemon leaves, the latter rooting readily whether treated or not. Untreated cuttings both leaf and leafy-twig of mottled Valencias and lemons had heavier root systems than healthy cuttings. Zinc treatment retarded the root growth of lemon leafy-twig cuttings. Untreated rooted mottled Valencia leafy-twig cuttings contained greater percentages of sucrose than the corresponding portions of healthy cuttings. The zinc treatment lowered the percentages of sucrose present in the leaves and roots at the end of the experiment. Field grown mottled leaves contained slightly higher percentages of reducing and total sugars in their dry matter than do healthy leaves ; this aids in a rapid recovery when the limiting feature has been corrected. In sand or soil cultures, excess of urea, urea-calcium nitrate mixtures, cyanamide, dicyanamide or arsenic induces partial chlorosis and, in the case of urea, little leaf. In solution cultures mottling has been produced only in the case of low or nil concentrations of zinc but under continuous high light intensities. Excess of zinc in culture solutions was successfully treated so as to improve growth by the addition of aluminium. The use of zinc in the culture solutions was followed by dark green colour in the leaves. The toxic or temporary retarding effect of zinc on growth was studied by coating with the zinc mixture the leaves of rooted cuttings grown in culture solutions.

534. Bartholomew, E. T. 634.334-2.19

Endoxerosis, or internal decline, of lemon fruits.

Bull. Calif. agric. Exp. Sta. **605**, 1937, pp. 42, bibl. 17.

In a previous article the author has described the effects of irrigation on the incidence of endoxerosis (*Phytopathology*, 1936, 26 : 1, 149-54, *H.A.*, 7 : 445). In the present article he gives a description of the characteristics of endoxerosis, varieties affected, general distribution and the differences between endoxerosis and *Alternaria* rot and membraneous stain. The results of the different experiments indicate that daily and protracted water deficits in the tissues concerned, high temperatures during the actively growing season, and the presence of substances which are more or less readily convertible into gum are the most important factors in producing endoxerosis in lemon fruits. Certain control or alleviating measures for grove and packing-house practice are suggested.

535. le Roux, J. C., and Crous, P. A. 634.31-2.19-1.8

Effect of fertilizers on creasing of Mediterranean sweet oranges.

Fmg S. Afr., 1938, **13** : 66-68, 85, bibl. 2.

Creasing or crinkly skin is a skin weakness appearing in the albedo, chiefly of the Mediterranean sweet orange in S. Africa, though other varieties are not immune. Outwardly folds or creases appear in the skin which bursts easily on pressure, causing considerable trouble in packed fruit. Manurial experiments carried out in an affected orchard of the eastern Transvaal indicated that loss of soil fertility was an important cause of creasing. Throughout the entire experiment a positive correlation was found between the amount of creasing and the poor condition of the tree.

536. WILLIAMS, R. O. 634.3-2.9
A decade of citrus fruit inspection in Palestine.
Hadar, 1938, **11** : 51-3.
An account of the development of the fruit inspection service in Palestine during the past 10 years, during which period the exports have risen from $1\frac{3}{4}$ million boxes to $10\frac{3}{4}$ million in the season 1936-37 and an enormous improvement in the quality of the fruit exported has been witnessed. Suggestions are made by which the service and export conditions generally could be still further improved.

537. PARK, M. 634.3-2.314
Citrus canker and its control.
Trop. Agriculturist, 1938, **90** : 127-35.
Citrus canker, caused by the bacterium *Pseudomonas citri*, is described with coloured illustrations. The only successful general control is by the destruction of every infected tree. This would be impracticable in Ceylon and suggestions are here made for at least partial control under different sets of conditions. *New plantings in disease-free areas.* When starting a new orchard infected trees within $\frac{1}{4}$ mile of the plantation should be burnt. Seeds may become contaminated during extraction and budwood may also be infected ; both, therefore, should be obtained from disease-free sources. A disease-free orchard will remain so unless contamination is brought in from the outside. A constant watch should be maintained and any infected trees immediately burnt. *New plantings in infected areas.* Under these conditions the chief precaution with new orchards should be to plant only resistant varieties such as mandarin, Jaffa and Valencia oranges or lemons. Grapefruit and limes are very susceptible to citrus canker. *In young infected areas.* In a plantation 2-5 years old which has become infected it would be worth while eliminating all susceptible varieties and replacing with resistant ones by replanting or top working. The planting of windbreaks has proved a valuable control in Japan. The infected leaves and twigs in light attacks may be hand picked and burned and the canker lesions excised from the larger branches. Such work must be thorough and regular to be effective. Spraying must be done regularly, for, though it cannot cure, it may prevent an outbreak. Since the spread of canker is often associated with leaf miner attack the spray should be a combined insecticide and fungicide ; an effective combination is colloidal sulphur or lime-sulphur to which $\frac{1}{8}$-$\frac{1}{4}$ oz. of nicotine sulphate per gallon of spray has been added. This should be applied every two weeks while the trees are in flush (the old leaves are not attacked). *In old infected areas.* In dry regions growth ceases during the dry season ; at its conclusion the trees should be stripped of all diseased leaves and shoots and the subsequent new flush sprayed weekly till the leaves have become tough, when treatment should cease. In order to neutralize the effect of stripping on the health of the tree a high standard of cultivation should be maintained. Bagging the growing fruit in paper bags is also effective and also keeps out fruit fly. Costings for these practices are not available.

538. STOFBERG, F. J. 632.752 : 634.3
The biology of the citrus mussel scale (*Lepidosaphes pinnaeformis* (Bouché) Kirk).
Sci. Bull. Dep. Agric. S. Afr. **165** (Plant Industry Series **23**), 1937, pp. 29, bibl. 10.
In this bulletin the economic importance and distribution of *Lepidosaphes pinnaeformis* (Bouché) Kirk throughout the citrus world and southern Africa, in particular, is described. A detailed description of the biology of the scale is given, including the rate and periods of reproduction, the number of generations per year, and seasonal development. The parasites and enemies are noted and some suggestions for control are given.

539. SMIT, B. 634.3-2.944
The cyanide fumigation of citrus trees in the Eastern Cape Province, South Africa.
Bull. Dep. Agric. S. Afr. **171** (Plant Industry Series **21**), 1937, pp. 39, bibl. 6.
The control of citrus scale insects by spraying with contact insecticides such as oil sprays has not proved very satisfactory in South Africa. On the other hand practically every scale insect

on branch, leaf and fruit can be killed by HCN fumigation. Such fumigation has consequently become a standard practice there. The whole process including the different methods of generating gas is described fully. Factors causing fumigation injury or poor scale kill are also discussed. The information is greatly enhanced by the numerous illustrations and figures given.

540. Wills, J. McG. 588.427
Passion fruit growing on the south coast (of Queensland).
Qd agric. J., 1937, **47** : 205-9, 328-32, 412-19, 489-98.

The author describes the cultivation of the common purple passion fruit (*Passiflora edulis*). The following points are dealt with :—*Climatic conditions. Cropping habit.* Fruit is borne on the current year's growth which is produced mainly from year-old wood. Maximum production is reached in 2-2½ years, and at 4-5 years the vines become commercially unprofitable. *Selection of site.* Adequate natural drainage is essential ; good forest land will produce a vine of good average growth without a tendency to excessive wood growth. Such soils require a good deal of working. *Preparation of land.* The land must be ploughed deeply and worked to a fine tilth before planting. If at all lime-deficient, lime must be added. *Trellising and planting distance.* The commonest planting distance is 10 feet between rows and 16 feet between plants in the row, thus allowing for natural vigorous expansion of vines along the trellis and enough room between the rows to work horse-drawn implements. Trellises may be horizontal or vertical, the posts in both cases being 7′ 6″ long, 7″ wide and not less than 4″ thick, set 16′ apart and 18″ in the ground with 10′ between rows. Strainers should be of much heavier material and there should be one every 80 posts. Notes on wire and fixing wire are given. *Propagation.* This is nearly always from well ripened seed though cuttings are also sometimes used. [N.B. In a brief note by an anonymous writer on p. 269 of this volume the use of cuttings is advocated.—Ed.] Seedlings are planted out when 6″ to 9″ in length. *Training the vine.* This should begin as soon as the seedlings have started into renewed growth on planting out. Adequate directions are given here. *Cultivation.* Surface soil must be broken up at least once yearly. *Manuring.* This varies according to soil conditions. *Pruning.* If left unpruned vines soon become a tangled mass in which disease is liable to develop. Notes on the guiding principles are given. In no case should vines be pruned heavily in dry weather. *Replanting.* Although young seedlings can be replanted among the old vines a regular rotation is preferable, which ensures the ground being entirely free from vines for certain periods. *Harvesting and packing.* Fruit must be gathered daily, preferably when cool in early morning or late evening, and at a proper state of ripeness. If destined for the fresh fruit market, it should be packed in half-bushel dump cases. *Diseases and pests.* The plant is comparatively free from insect pests. Only brief notes are given here on diseases, these being fully covered in J. H. Simmonds' pamphlet on the subject issued by the Department of Agriculture and Stock, Brisbane.

541. Zhigarevich, I. A. 633.88.11.871
Eucalyptus as a genus for commercial exploitation. [Russian, English summary 25 lines.]
Bull. appl. Bot. Leningr., 1936, Ser. XI, No. 1, pp. 95-135, bibl. 21.

A concise survey of the history of the introduction of *Eucalyptus* to the Caucasian Black Sea coast. Its botanical composition and the biological and technical properties of 26 species are described briefly. Notes are given on the cultivation of this plant and its use in various industries. Data obtained from the Laboratory of Tanning Substances of the Institute of Plant Industry, from the Sukhum Station of the Institute of Plant Industry in the humid subtropics and from various foreign sources, are tabulated. The questions connected with the introduction of *Eucalyptus* were studied at the Sukhum Station. *E. viminalis, E. globulus, E. Gunii, E. amygdalina, E. cinerea, E. Macarthuri* and some other species were found to be sufficiently hardy for cultivation. *Eucalyptus* may be grown on the Caucasian Black Sea coast with two different objects in view :—1. To develop a large scale timber industry combined with accessory utilization of tannins, wood pulp and essential oils. 2. For the manufacture of essential oils

and tannins from shrubs. The second type of cultivation should prove economically valuable only for non-hardy species which give valuable products for the essential oil industry. The most suitable area for cultivating *Eucalyptus* is said to be the coastal zone stretching from Sochi to Batum and not ascending to greater heights than 300 m. above sea level.

542. Di Cairano, V. 634.55
La coltura del mandorlo in Tripolitana. (**Almond cultivation in Tripoli.**)
Agricoltura colon., 1937, **31** : 41-58.

Colonization in Tripoli is based on 3 chief crops, the olive, the almond and the vine. The almond offers the great advantage of a very rapid growing and fruiting season. It starts growth very early and is in flower in January ; in June the almonds are ripe and the tree enters into dormancy. The author gives a full account of its cultivation with notes on recommended varieties. Propagation is preferably by T budding on wild bitter seedlings in full growth from February to April a year after planting out, the bud being inserted 20-30 cm. from ground level. Pruning operations, which are necessary every year, are simple. Manuring should not be done till the winter after budding, when applications in the proportion of 4 parts mineral phosphate to 1 part sulphate of ammonia to 0·75 parts sulphate of potash are made. Afterwards fertilizers should be given every two or at most every three years. Brief notes are given on harvesting and on pests.

TROPICAL CROPS.*

543. Abeele, van den, — 63
Aperçu de la situation de l'agriculture au Congo belge. (**Review of the agricultural situation in the Belgian Congo.**)
Bull. Inst. agron. Gembloux, 1937, **6** : 1-16.

A general account is given of the present state of agriculture in the Belgian Congo and of the manner in which, largely owing to the prompt action by the government, it survived the world-wide financial depression of 1929-34, during which period the number of Europeans in the Colony was reduced from 25,000 to 17,000, and many of the smaller plantations were abandoned. Arising from the general shortage of money was the discovery that plantations, chiefly cotton and oil palm, could be efficiently worked with about half the labour, both European and African, hitherto considered necessary. The prospects of various exportable crops at the present time are discussed and the need for additions to the few now grown is stressed. Among those which might be taken up are cacao, sisal and certain tropical fruits, native woods, geranium oil, quinine and others.

544. Cook, M. T., and Otero, J. L. 63 : 581.084
History of the first quarter of a century of the agricultural experiment station at Rio Piedras, Puerto Rico.
Bull. agric. Exp. Sta. Puerto Rico **44**, 1937, pp. 123.

A review of the history and work accomplished at the experimental station from 1910, when it was established by the Sugar Producers' Association of Puerto Rico, to the present day. A complete list of circulars, bulletins, annual reports, journals and notes published by the station is given. With the exception of the journal (1928-36) most of these publications have been translated, edited, prepared and corrected for the press by the Library. Some of the circulars have been published in English, others in Spanish. They contain popular articles and sometimes papers of local interest. Bulletins are of a semi-popular character but usually involve the results of research. The journal is a technical quarterly publication and is published in English.

545. Singh, B. N., Singh, S. N., and Srivastava, M. B. 631.874 : 612.014.44
Photoperiodism, a factor in determining the manurial efficiency and distribution of *Crotalaria juncea*.
Reprinted from *J. Amer. Soc. Agron.*, 1937, **29** : 123-33.

In this paper the influence of different exposures to light upon the manurial value of *Crotalaria juncea* is discussed. The following conclusions were reached :—When the plant was subjected

* See also 419.

to prolonged exposures to light, its height, the number of its leaves, its leaf area, its root length and the number and weight of its root nodules as well as the length and the yield of fibre were found to increase. Some of these characters reached their maxima under continuous illumination, while the others required only 20 hours exposure, longer exposure resulting in solarization. The critical period for this plant was found to lie within a 16- to 20-hour day. By exposing *Crotalaria* to light beyond this range, the plant was said to be unable to pass from the vegetative stage to the next. Manurial efficiency was stated to increase with a prolonged photoperiod, attaining its highest value at 20 hours' exposure.

546. Singh, B. N., and Singh, S. N. 631.874 : 633.524.1
Analysis of *Crotalaria juncea* with special reference to its use in green manuring and fibre production.
Reprinted from *J. Amer. Soc. Agron.*, 1936, **28** : 216-27, bibl. 5.

Chemical analyses were made of *Crotalaria juncea* at successive stages of its life cycle. Simultaneously growth studies were carried out, and chemical constituents of the plant were recorded as percentages of dry matter and of absolute weight, and the amount per acre which would be added to the soil by its incorporation. The following conclusions were reached :— The amounts of organic matter, nitrogen and other essential elements were found to increase with the age of the plant, reaching a maximum towards the end of the adolescent stage. The absolute quantities of these materials for the entire plant and those calculated on an acre basis were stated to attain maximum values when the plant was in its practical senescence, while the maxima for leaves and roots were reached at the beginning of the reproductive stage. In analyses of the various parts of the plant it was found that the leaves have the highest manurial efficiency. The fibre content was found to be greater in senescent plants, but the quality of the fibre was better when the plant was in the adolescent stage. If both green manuring and fibre production are desired, the authors recommend that the stems of 75-day-old plants should be used for fibre and that the leaves, tops and roots should be ploughed in for manure.

547. Dennett, J. H. 631.875
Organic composts.
Malayan agric. J., 1938, **26** : 104-12, bibl. 8.

An account is given of experiments conducted in composting, following the Indore process, by the Malayan Department of Agriculture. Contrary to Howard's experience it was found that the wet weather had a considerable effect on the compost heaps, slowing down the initial stages of decomposition and producing a tendency in the lower layer to become semi-anaerobic with a complete fall of the temperature to normal. Analysis showed that the potash and phosphate contents and to a slight degree the nitrogen contents were reduced by wet weather. In Malaya, where annual crops are not prominent, it is difficult to obtain sufficient waste, but pineapple trash is available though disintegration is slower than with mixtures of grass and leaves, which are the alternative. The average actual value of pineapple trash compost in terms of mineral fertilizer, assuming all nutrients are readily available, is 5 tons of finished compost = 1 cwt rock phosphate, 4 cwt sulphate of ammonia and ½ cwt sulphate of potassium. Local preparations of compost in Malaya in the equatorial rain belt have a C/N ratio of between 20/1 and 25/1 as against the 15/1 obtained in monsoon weather at Indore. In spite of this high ratio the finished product is considerably richer in nitrogen than that obtained in India. This C/N ratio can be adjusted immediately before use by the addition of about 1½ lb. of sulphate of ammonia per 100 lb. of compost.

548. Timson, S. D. 631.874
Compost.
Bull. Dep. Agric. S. Rhod. **1048**, 1937, pp. 42, bibl. 9, being reprinted from *Rhod. agric. J.*

Considerable attention is paid to composting the sunnhemp green manure crop in Rhodesia. The report is clearly arranged in 5 sections thus enabling the reader to find the practical information contained in it without waste of time.

549. Salgado, M. L. M. 631.86 : 636.39
Goat manure.
Trop. Agriculturist, 1938, **90** : 30-33.
The manurial value is discussed of goat manure in Ceylon and comparison made between estate goat manure collected from sheds where the goats are kept at night and contractors' goat manure which is often adulterated by watering. The former proved to be a high grade product, rich in nitrogen, averaging 3%, and containing a fair amount of phosphoric acid and potash. Contractors' manure was definitely poorer, particularly in nitrogen, and contained only half the amount of organic matter, being largely contaminated with sand. The respective values per ton calculated at present prices of artificial manure would be Rs. 25 for estate goat manure and Rs. 17 for contractors' goat manure. For use with annual crops the hard pellets are ground before application ; this is unnecessary with a perennial crop. The rate of application (presumably of estate manure.—Ed.) recommended for coconuts is 28 lb. plus 3 lb. bonemeal and 1 to 1½ lb. muriate of potash, or instead of the muriate of potash a kerosene tin full of ash. If green manure is applied, the goat manure may be reduced at the rate of 10 lb. for every 100 lb. of green manure.

550. Rhodesia, Minister of Agriculture and Lands. 631.67
Small earthen storage dams. Parts I and II.
Bull. Dep. Agric. S. Rhod. **1052,** 1938, pp. 16 and **1055,** 1938, pp. 16, being reprinted from *Rhod. agric. J.*
In part I a general description is given of small earthen storage dams for water. In part II design and construction of such dams are discussed with the aid of diagrams.

551. Kerr, H. W. 631.67
Spray irrigation.
Reprinted from *Cane Growers' Quarterly* in *Qd agric. J.*, 1937, **31** : 270-4.
Details are given of the construction, installation and costs of a 5-acre spray unit, especially useful for use in sugar cane plantations. The initial installation outlay in Australia is estimated at about £40 an acre. The advantages and disadvantages are here discussed.

552. Maclachan, R. J. 632.6
Further note on use of crude oil to prevent damage by crabs.
Malay. agric. J., 1938, **26** : 114.
To prevent damage by the undermining of bunds in Malaya by crabs ¼ pint of a mixture consisting of 3-4 lb. of slaked lime in 3-4 gallons of water, to which has been added ½-1 pint of crude oil and 1 oz. of arsenical white ant powder, is poured down each active crab hole which is then blocked. The treatment is repeated once a month until the locality is cleared. Treatment of this nature over a long period progressively renders the soil disagreeable to crabs. The value of the lime and crude oil have been tested by controlled experiments but the value of the ant powder has not been so tested. A small drain may also be dug about 20-30 feet on the inner side of the bund to intercept horizontal seepage through the soil under the bund. This has the effect of draining the soil and rendering it unsuitable for crabs.

553. Johnpulle, A. L. 634.61-2.76-2.96
Temperatures lethal to the green muscadine fungus, *Metarrhizum anisopliae* (Metch.) Sorok.
Trop. Agriculturist, 1938, **90** : 80-3, bibl. 4.
Temperatures lethal to spores of the green muscadine, *Metarrhizum anisopliae*, were studied with a view to testing the biological control of coconut rhinocerus beetle in the compost pits where it breeds. Germination of the spores was inhibited at 50° C., but below 48° C. conditions favourable to germination were obtained. The temperature of a new compost heap soon rises to 70° C., at which level it remains for a fortnight, nor does it fall below 48° C. for 6 weeks. The susceptible larval and pupal stages of the beetle last for 18 weeks so that at least 12 weeks are available within which the fungus might be able to infect the insect. Under laboratory conditions the

larvae are killed by the fungus in a much shorter time. It is considered that inoculation of the pits after the temperature has fallen below 48° C. might prove a successful means of control.

554. Chevalier, A. 632.951
Plantes ichtyotoxiques des genres *Tephrosia* et *Mundulea*. (**Fish poison plants, *Tephrosia* and *Mundulea*.**)
Rev. Bot. appl., 1937, **17** : 9-27, bibl. 7.

The dispersion, cultivation and insecticidal properties are discussed of a number of plants of the genera *Tephrosia* and *Mundulea*.

555. Chevalier, A. 632.951
Sur un groupe de plantes insecticides ; les Stemona d'Indochine. (**Species of *Stemona* as sources of insecticide.**)
Rev. Bot. appl., 1937, **17** : 136-7, bibl. 4.

About 35 species are known (*Stemonaceae*) of these tuberous rooted monocotyledons, mostly from the eastern tropics, of which those known to possess insecticidal properties are *S. tuberosa* Lour., *S. sessilifolia* (Miq) Franch and Sav., *S. Collinsae* Craib., *S. Burkillii* Prain, *S. moluccana* (Blum) C. H. Wright. The preparations are obtained by powdering the roots and are as yet little known.

556. Greig, J. L. 633.72
Cultivation of lowland tea at the Central Experiment Station, Serdang.
Gen. Ser. Dep. Agric. S.S. and F.M.S. **29**, 1937, pp. 31, bibl. 7, 50 cents.

The bulletin is published as a result of observations over a number of years by the Department of Agriculture, S.S. and F.M.S. Intentionally no comparison or preference is expressed as between lowland and highland tea. A bulletin on the latter is to follow. *Planting.* Mature woody stumps have proved superior as planting material to germinated seedlings or seedlings with earth attached. Methods of seed sowing and after treatment of nursery plants are described. *Shade.* Very satisfactory growth and yields have been obtained under wide-spaced high shade. There has been no opportunity of comparison with unshaded lowland tea. *Cover crops. Crotalaria usaramoensis* is to be preferred to *C. anagyroides* and *Tephrosia candida.* The practice is to sow a mixture of 10% seed and 90% basic slag between every second row across the slope, amounting to $\frac{1}{2}$-$\frac{3}{4}$ cwt per acre. *Plucking.* Fine plucking, i.e. 1 leaf and 2 buds, at intervals of 8-9 days is practised. *Period of plucking and pruning.* After 30-36 months of growth from planting out the young tea, now 5 or 6 feet high, is centred and cut back to 20 inches. Trees so treated show undiminished vigour after 30 months' continuous plucking. Pruning (rim-lung) following a rest of 3 months is performed in the wet weather, at a height of 3 to 4 inches above previous pruning cuts and the trees are brought into plucking again after 90 days. *Forking and manuring.* After pruning the fallen leaves from prunings, mixed with a proportion of artificial manure, are envelope-forked into the soil, i.e. the fork is forced into the ground, pushed forward after some preliminary to and fro movements and the leaves and debris swept into the cavity with the labourer's foot and pressed down ; on the withdrawal of the fork the soil falls back and is trodden in. This method avoids undue root disturbance. The remainder of the bulletin gives the histories of the experiment blocks, briefly discusses points of manufacture and the costs of bringing an estate into bearing and of production.

557. François, M. T. 633.72
La culture du théier en Russie méridionale. (**Cultivation of tea in south Russia.**)
Rev. Bot. appl., 1937, **17** : 789-96.

Tea cultivation in Georgia, U.S.S.R., is briefly described and the conditions for cultivation compared with those of other tea growing countries. Very high yields are reported compared with those of other countries, but on investigation it appears that this is because a much larger part of the shoot is plucked than is customary elsewhere.

558. TANGANYIKA TERRITORY, DEPARTMENT OF AGRICULTURE. 633.73 : 577.15.04
Quarterly notes of the Coffee Research and Experiment Station, Lyamungu, Moshi, **4**, 1937, pp. 7.
On p. 4 is a brief note of the effect of the commercial preparation Hortomone A on the rooting of coffee cuttings. In 2 experiments at the end of 3 months 5 times and 3 times as many treated cuttings had rooted as untreated. At the end of 5 months the proportion in both cases was ± twice the number of treated to untreated cuttings. Semi-hardwood cuttings benefited the most, in fact it is doubtful whether softwood cuttings benefited at all. There seem to be differences in ease of rooting between cuttings of equal maturity from different trees or from different parts of the same tree. This point is being further investigated.

559. CIFERRI, R. 633.73 : 575.252
Osservazioni su alcune mutanti del *Coffea arabica*. (**Notes on a few *C. arabica* sports.**)
Agricoltura colon., 1937, **31** : 515-21.
The author describes 5 sports of *C. arabica* noted by him in the Dominican Republic. They are as follows : –(1) A coffee of the Maragogipe type, similar to the *Maragogipe* variety discovered in the State of Bahia, Brazil, in 1870 ; (2) a thin leaved type ; (3) a coffee of the amarella type giving yellow and red berries ; (4) a type with pubescent leaf petioles, *C. arabica* var. *pubescens* nob. n. var. ; and (5*a*) and (5*b*) a type with very long or very short leaf stipules (*C. arabica* var. *longistipulata* nob. n. var. and *C. arabica* var. *brevistipulata* nob. n. var.).

560. FERWERDA, F. P. 633.73 : 581.331.2
Kiemkracht en levensduur van koffiestuifmeel. (**Germinating power and longevity of coffee pollen.**) [English summary.]
Arch. Koffiecult., 1937, **11** : 135-50, bibl. 15.
Germination tests of pollen taken from *Coffea robusta*, *C. excelsa* and certain interspecific hybrids are described. Fresh pollen of *C. robusta* and *C. excelsa* germinates to the extent of 70-85%. Arabica-robusta hybrids and seedlings of liberica-arabica hybrids show very poor pollen germination due to the large proportion of wrinkled, non-viable grains. The origin of this is probably cytological. Air-dry pollen loses its germinative power in a week but if kept in a desiccator over quicklime germinating and fertilizing power may be retained for over a month.

561. GANDRUP, J. 633.73-1.541.6 + 1.541.4
Een korte omschrijving van plakzoogen en het maken van wortelenten. (**Approach grafting and root grafting of coffee.**)
Bergcultures, 1936, **10** : 1082-4.
A method of approach grafting young seedling coffee by inarching on to another seedling below the cotyledons is described. Thus a seedling variety prone to root troubles might be grafted on to a seedling rootstock from a resistant variety. The author points out that this is not to be mistaken for a clonal plant just because it is grafted. It will always be a seed plant and, therefore, of uncertain potentialities. A method is described of grafting thin clonal roots with very young seedlings just emerging from the cotyledon stage. When this combination has grown, the scion is top grafted with a scion from a selected tree. The plant then consists of clonal top and roots with only a seedling intermediate. [The method was described in more detail by C. C. Ament, "Wortel-enten van koffie." *Arch. Koffiecult.*, 1936, 10 : 1-13, and will be further discussed in a Technical Communication, The vegetative propagation of tropical and subtropical crops, Part II, to be issued shortly by this Bureau.]

562. FALLON, F. 633.73-1.459
L'érosion du sol dans les plantations de café. (**Soil erosion in coffee plantations.**) [Short English and German summaries.]
Bull. Inst. agric. Gembloux, 1937, **6** : 120-30.
The first stage of soil erosion is the crumbling of the surface layer brought about by the action of insolation, chemical agents, water, wind and rain. When pulverized and desiccated the soil

is carried away by rain and wind. Means of preventing erosion are described. These are deep ploughing to facilitate the penetration of rain water, covering the soil with straw or other mulch, the digging of trenches on a slant with the gradient line, the use of cover crops either perennial or self resowing, banking along the level contours or round each plant, and the digging of trenches at right angles to the gradient and ½ to 1 metre from each plant. These last are designed to hold up water and silt and can also be used for burying weeds, etc. At the end of a season they will be full of silt and humus. Fresh ditches in slightly different positions are dug each year and the whole field is gradually worked over with markedly beneficial results.

563. Bauer, A. 631.8 : 633.73
Zur Frage der Düngung des Kaffeestrauches. (**The use of fertilizers for coffee.**)
Ernähr. Pfl., 1938, **9** : 153-6, bibl. 19.
A review of literature on the planting of coffee and on coffee diseases, particularly such as are due to mineral deficiency.

564. Montserin, B. G. 632.693.2 : 633.74
The tree rat as a pest of cacao in Trinidad.
Publ. Dep. Agric. Trin., 1937, pp. 12.
An account is given of the tree rat of Trinidad, a notorious pest of cacao. Almost complete control was obtained by the use of a poison bait of bananas into which 10-14 phosphorus-headed matches had been inserted through the skin. A strip of the skin is removed on one side to render the bait easy of access. The bananas cut into 2 or 3 pieces are put in places frequented by the rats, chiefly the forks of trees. On the second day after this bait was laid down losses of cacao pods almost ceased. After 48 hours the baits break down and lose their attractiveness. This bait was taken readily when a number of other recognized rat poisons were disregarded or ineffective.

565. Milsum, J. N. 633.88
Local areca nuts.
Malay. agric. J., 1938, **26** : 59-63, bibl. 1.
The yields of 13 varieties of areca nuts grown from seed by the Agricultural Department, Malaya, at Port Swettenham, are compared and the varieties, it is hoped, identified. The areca is normally cross-pollinated and the extent to which it breeds true is as yet not determined. The palms established at Port Swettenham have, however, retained the distinguishing varietal characters of fruit and nut of the mother palms. Illustrated descriptions of the varieties have already been published (Sands, W. N., *Ibidem*, 1926, 14 : 202). The yields of the areca on the heavy alluvial clay at Port Swettenham were considerably higher than the yields of those on the hill quartzite soil at Serdang, although not strictly comparable owing to differences in spacing. The average rate of growth of young palms is 4 ft. per annum and they now measure 40 ft. high from ground level to the apex of the young leaves. Results of analysis of fruit and nut are tabulated. The moisture content of pericarp and nut determined for 8 varieties averaged 80·6 and 43·2% respectively.

566. Moore, A. 633.912
Rubber growing : elementary principles and practice.
Plant. Manual Rubb. Res. Inst. Malaya **7**, 1938, pp. 82, 50 cents.
This manual provides all the information on rubber cultivation likely to be required by the smallholder and is well illustrated. It is hoped to increase its usefulness by issuing it in Chinese.

567. Beckett, R. E., Stitt, R. S., and Duncan, E. N. 633.913
Rubber content and habits of a second desert milkweed (*Asclepias erosa*) of Southern California and Arizona.
Tech. Bull. U.S. Dep. Agric. **604**, 1938, pp. 11, bibl. 10.
The rubber content of wild plants of *Asclepias erosa* collected in Arizona ranged from 2·45-13·06% with a mean of 8·57%. The leaves contained 90% of the rubber, a higher content

than was obtained from any of the other milkweeds. Leaves were stored for 18 months without appreciable loss in rubber content. The plant in cultivation is raised from seed and presents no cultural difficulties in a suitable climate. At the U.S.A. Acclimatization Garden, California, where progenies were established to obtain data on the inheritance of rubber-yielding capacity, full rubber-yielding capacity appeared early in the life of the plant, many 1-year-old plants having a rubber content equal to 75% of that of the parents. In some individuals the rubber content in the first season was higher than that of the parents.

568. Jarry-Desloges, R. 634.343-1.541
Le greffage de *Casimiroa edulis* La Llave. (**Grafting *C. edulis*.**)
Rev. Bot. appl., 1938, **17** : 122-5.

Among *Casimiroa edulis* grown from seed are many with undesirable characters such as small and bitter fruit, low yields from various causes such as failure to flower or a too heavy fruit drop. The propagation of superior varieties only is necessary. At Mentone contrary to expectation inverted T shield budding has proved very successful. To raise good seedling rootstocks the seed must be sown immediately on extraction from the fruit, whether under glass or in the open will depend on the climate. In the south of France a temporary glass shelter is needed and the stocks are grown in pots, care being taken not to break the ball of soil when re-potting. They are budded and planted out when about two years old.

569. Singh, B. N., and Lal, B. N. 634.441 : 581.163
Investigation of the physiological and chemical changes accompanying viviparous germination in mango.
Reprinted from *J. Indian bot. Soc.*, 1937, **16** : 129-36, bibl. 10.

Studies of physiological and chemical changes in the mesocarp and seed of normal and viviparous fruits. Deshi mangoes were taken from trees at different heights and were separated into the epicarp, the mesocarp, the endocarp and the seed. For each sample of mesocarp and of seed temperature, water content, H-ion concentration, respiration, carbohydrates and total nitrogen were determined separately. Ten analyses were made in each case, the average being then taken. The following conclusions were reached :—The mesocarp of the normal fruit as compared with that of the viviparous fruit showed a higher output of CO_2, higher moisture content, higher pH, higher percentage of non-reducing sugars, of starch and of total nitrogen, but a lower percentage of reducing sugars. The endocarp in the viviparous fruit was found in all cases to be split at its broader end, which was not the case with the endocarp in the normal fruit. Trials showed that the split condition favoured germination. The following changes were found to take place inside the seed of the viviparous fruit as compared with those occurring in the normal fruit :—The rate of respiration, particularly in the plumule and radicle, was higher. The temperature and moisture content showed an increase, while a decrease in pH, especially in the plumule and radicle was noted. There was a loss in starch and in non-reducing sugars, but the quantity of reducing sugars increased, this increase being particularly marked in the plumule and radicle. There was a loss of nitrogen from the cotyledons and an increase of nitrogen in the plumule and radicle.

570. Ceylon, Department of Agriculture. 634.441-1.541.1/5
The propagation of the mango in the dry zone.
Leafl. Dep. Agric. Ceylon **113**, 1937, pp. 4.

This leaflet contains a description and illustration of a new method of budding the mango. The method has recently been described and abstracted [*Trop. Agriculturist*, 1937, 88 : 86-91, *H.A.*, 1937, 7 : 756], and the wording in the leaflet is substantially the same.

571. Paul, W. R. C., and Guneratnam, S. C. 634.441-1.541.11
Mango stocks.
Trop. Agriculturist, 1938, **90** : 34-5.

Mango seeds used for rootstock purposes are better able to germinate if the endocarp is opened and the kernel extracted. This is done by removing with a sharp knife a strip of the seed coat

along that edge which is ruptured when germination takes place normally. The cut edges are prised up and with a little pressure on the two flat sides of the seed coat the kernel can be gently squeezed out. Quickest germination seems to be effected by planting the seed erect at a depth of 1 inch. The 2 stocks giving most promise are the sour mango or semi-wild varieties of *Mangifera indica* and the Ceylon wild mango or varieties of *Mangifera zeylanica*. The sour mango is ready for budding in 9 to 12 months while the slower growing wild mango requires nearly 18 months. The sour mango transplants well, especially if the root laterals are well developed as a consequence of cutting the tap root when potting. The wild mango develops fewer laterals, but owing to its long tap root it is possibly more drought resistant. It is, however, difficult to transplant, if the tap root has been injured.

572. Moore, R. H. 634.58-1.811
Nutritional levels in the peanut plant.
Bot. Gaz., 1937, **98** : 464-90, bibl. 25.
The investigation was concerned with the responses of the peanut (*Arachis hypogaea*) to variations in the supply of light and available nitrogen. Greatest vegetative extension and greatest fruitfulness occurred in the same cultural treatment. High-nitrogen plants were dark blue-green in colour, slender-stemmed and succulent ; high carbohydrate plants were pale yellow-green, thick-stemmed and firm in texture. The fruiting tendency in the peanut was less sensitive to nutritional changes than that of the tomato. A number of other effects are also recorded. Ammonium nitrogen nutrient solutions, which do not precipitate when applied at pH 7·1, are reported. A method for determining nitrates by a 6-hour aeration period is described.

573. Joachim, A. W. R., Panditteseker e, D. G., Kandiah, S., Koch, D. E. V., and Charavanapavan, C. 581.192 : 634.1/7 + 635.1/8
The analysis of Ceylon foodstuffs.
Trop. Agriculturist, 1938, **90** : 3-29, bibl. 30.
A series of 5 papers dealing with the analysis of the principal foodstuffs available to the poorer inhabitants of Ceylon. The vitamin C content for a large number of fruits was determined. Poor sources of vitamin C were avocado, banana, coconut, jack fruit, bael, mangosteen, wood-apple and sugar cane. Guavas, citrus, papaws, some mangoes, rambutan, hog plums and tomatoes had good vitamin C content. Soursop, custard apple, pineapple, tree tomatoes and bilimbi are of intermediate value.

574. Bliss, D. E. 632.4 : 634.62
Crosscuts in the fruitstalks of date palms.
Pap. Univ. Calif. Citr. Exp. Sta. **377**, 1937, pp. 7, bibl. 5.
A report on studies of the nature of the crosscut disease held at the Fourteenth Annual Date Growers' Institute in Coachella Valley in April 1937. The disease is of little economic importance in the Coachella and Imperial Valleys of California. It is most common in the Sayer variety, but is also found in some others. It is said that in commercial plantings of the Sayer variety a certain loss from crosscuts is anticipated each year and is provided for in the spring by retaining more fruit bunches than are expected to mature fruit. Thus an adequate harvest can be secured in spite of the injury caused by the disease.

575. Bliss, D. E. 632.44 : 634.62
The spread of decline disease in date palms.
Pap. Univ. Calif. Citr. Exp. Sta. **375**, 1937, pp. 7, bibl. 8.
A report of the Fourteenth Annual Date Growers' Institute held in Coachella Valley in April 1937, reviewing the cause and nature of the decline disease. This was first observed in 1921, when it affected approximately 800 palms. The causal organisms are said to be two species of *Omphalia*. They were found capable of existing indefinitely as saprophytes on various kinds of organic matter and to possess remarkable longevity under conditions unfavourable to growth. There is said to be little evidence as to how much the spores of *Omphalia* species affect the spread of

the disease. The mycelium apparently grows through the soil from tree to tree, and is carried on the diseased palms and their offshoots. Several instances are given in which decline disease spreads outward over Deglet Noor palms from one focus of infection. It is indicated that the first phase of the malady is confined to the roots and that detached portions of diseased palms are potential carriers of *Omphalia* species. The epidemiology of decline disease is discussed briefly, and it is suggested that the spread of the disease should be limited by soil disinfection and by the use of healthy offshoots for planting.

576. Ciferri, E. 634.771
Notizie sulle principali razze di banano coltivate nella Repubblica Dominicana.
(**Notes on the chief banana varieties cultivated in the Dominican Republic.**)
Agricoltura colon., 1937, **31** : 58-65, 98-111, bibl. 19.

The features and cultivation of following varieties or strains are described : —*Musa Sapientum* L. Sosúa (syn. Johnson) and Guineo de rosa (syn. Guineo del cura) ; *M. Cavendishii* Lamb Congo (syn. Guineo Congo) ; *M. corniculata* Rumph. Rulo ; *M. paradisiaca* L. Morada (syn. Morado, Plàtano morado, Colorado), and Plàtano (syn. Plàtano comùn). A key is given for easy differentiation of the above based on size of tree and character of fruit. Local methods of cultivation are discussed.

577. Simmonds, J. H. 632.48 : 634.771
Squirter disease in bananas with special reference to its control.
Qd agric. J., 1937, **31** : 542-8, bibl. 10.

The author gave a full account of the symptoms and incidence of the squirter disease caused by *Nigrospora* spp. in *Qd agric. J.*, 1933, 40 : 98-115 ; *H.A.*, 3 : 581. He here deals chiefly with control measures. Removal of all dead leaf material and bracts from a block of plants and spraying the packing shed with formalin had little effect the same year on ultimate incidence of squirter in the fruits. After various experiments with formalin and Shirlan suspensions, etc., it is considered that a practical and economic method of control is available. Immersion of the fruit as singles (or part hand when so packed) in a 1% suspension of Shirlan A.G. (a commercial preparation consisting of a 25% suspension of salicylanilide in water plus a wetting and spreading agent) is recommended as a routine practice during the winter and early summer months on all plantations where losses from squirter are likely to occur. This treatment also reduces black end, especially that due to *Nigrospora*. Hands should be broken into singles and dipped in the mixture as soon as possible after removal from the bunch. After immersing they are drained for a few minutes before packing. Where infection is scarce the prevention of chilling and sanitation measures in plantation and packing shed should suffice, but where it is more prevalent dipping will also be necessary.

578. de Soyza, D. J. 635.2
Yam cultivation in the Kegalla district (Ceylon).
Trop. Agriculturist, 1938, **90** : 71-9.

In this paper the custom of the district is followed and yam is taken to include, besides *Dioscorea*, cassava, sweet potato, and various edible aroids and some aquatics. Cultural notes are given for most of them. A planting calendar is given which, if followed, would ensure a supply of edible roots of one sort or another throughout the year.

579. Smart, H. P. 635.23
The cassava industry in British Honduras.
Bull. imp. Inst. Lond., 1938, **36** : 66-8.

A note is given of the establishment of the first private factory in British Honduras for the manufacture of cassava starch. The product obtained by a small experimental factory on the Agricultural Station at Star Creek was estimated by purchasers in Canada to equal the best Java starch.

STORAGE.*

580. MARTIN, W. E. 664.85.13 : 581.192
Chemical study of the ripening process of Bosc pears.
Bot. Gaz., 1937, **99** : 42-68, bibl. 18.
Temperatures of 65°-70° F. are necessary for the proper ripening of Bosc pears after storage. This paper deals with a study of the ripening process by means of chemical analysis and the studies are carried on until internal breakdown from over-ripeness occurs. The attainment of fruit of good eating quality appears to occur in the four days following the beginning of hydrolysis of sucrose. The essential differences in the sugar content of ripe and over-ripe Bosc pears appear to be the relative amounts of sucrose and reducing sugars. Total sugars show no decrease with over-ripening, but the amounts of reducing sugars are far greater and the amounts of sucrose far less than in fruit of good eating quality. Sorbitol was identified as a constituent of Bosc pears and a quantitative method was devised for its measurement. The decreases of sorbitol during the ripening process of these pears were large enough to account for the observed increases in total sugars.

581. HANSEN, E. 547.313.2 : 664.85
Chemical changes of fruits ripened in the presence of ethylene.
Science, 1937, **86** : 272.
Experiments with pears, gooseberries, peaches, lemons and other fruit, indicate that certain ripening changes, such as softening of the tissues, formerly considered to be of a " physical " nature, are really a result of chemical changes which can be influenced by ethylene treatment.

582. KALTENBACH, D. 547.313.2 : 664.84 + 664.85
Artificial colouring and ripening of fruits and vegetables with ethylene.
Int. Rev. Agric. (*Mon. Bull. agric. Sci. Pract.*), 1938, **29** : 81T-116T, bibl. 39.
Much of the available information on the use of ethylene for the artificial colouring and ripening of fruits and vegetables is summarized under the following heads. (1) History. (2) Production of ethylene by fruits during ripening. (3) Properties of ethylene. (4) Action of ethylene in the biochemical process of maturation. (5) Action of ethylene on different fruits. (6) Material and methods employed in the artificial colouring and ripening with ethylene. (7) Study of factors affecting the process of artificial colouring and ripening. (8) Practical application of ethylene in the artificial colouring and ripening of various fruits. (9) Ethylene in the product treated.

583. CARNE, W. M., AND MARTIN, D. 664.85.11.035.1 : 632.19
Apple investigations in Tasmania : miscellaneous notes. 8. The influence of carbon dioxide concentration on brown heart and other storage disorders.
J. Coun. sci. industr. Res. Aust., 1938, **11** : 47-60, bibl. 9.
This progress report embodies tabulated results obtained from the following experiments with apples during 1930 and 1937. 1. Continuous storage for 8 weeks under low concentrations of CO_2. 2. Pre-storage treatment with high concentrations of CO_2. 3. CO_2 accumulation in the early part od the storage period.

584. CARNE, W. M. 664.85.11 : 632.19
The statistical relation of crop size to the incidence of storage disorders in apples and to their chemical and physical characters. I. Results obtained in 1936 and 1937.
J. Coun. sci. industr. Res. Aust., 1938, **11** : 83-6, bibl. 6.
Positive correlations in both years were obtained between the average size of fruit (a measure of the size of the crop) and the liability of the fruit to pit and breakdown ; between the average size of the fruit and the titratable acidity of the juice, the penetration tests and the starch-iodine reaction ; between the titratable acidity of the juice and the penetrometer tests ; and between

* See also 398-400.

the starch-iodine reaction and the pit liability. No correlation was found between the average size of the fruit and pH and refractive index of the juice; or between the refractive index and pit liability. The correlation between titratable acidity of juice and the percentage of breakdown was doubtful. There was a correlation between the refractive index of the juice and the titratable acidity and also the penetrometer tests in 1937 but not in 1936. No correlations with the ground colour were obtained on the present basis of evaluating colour. The possible correlation between climate and breakdown will require a range of seasons before it can be tested. [From author's summary.]

585. Nel, R. G. 664.85.037 : 632.772
The utilization of low temperatures in the sterilization of deciduous fruit infested with immature stages of the Mediterranean fruit fly (*Ceratitis capitata* Wied.).
Sci. Bull. Dep. Agric. S. Afr. **155**, 1936, pp. 33, bibl. 8.
A series of experiments with nectarines, peaches, plums and grapes undertaken at the Low Temperature Research Laboratory, Capetown, during the years 1932-35 is here recorded. The author states that all the immature stages of the Mediterranean fruit fly *Ceratitis capitata* Wied were destroyed by constant exposures of 9 days at 31° F., 12 days at 34° F. and 16 days at 37° F. They were also destroyed by subjecting infested fruit to the following varying low temperatures: 2 days at 31° F. and 17 days at 34° F.; 4 days at 31° F. and 6 days at 37° F.; 4 days at 34° F. and 12 days at 37° F. No stage of the fruit fly was found to survive when heavily infested grapes were shipped under commercial conditions to the Farnham House Laboratory, England. The author concludes that the temperatures used in the existing methods of commercial precooling and refrigerated transport guarantee the disinfesting of fruit, and that therefore additional precautionary measures against this pest at the ports are superfluous.

586. Colhoun, J. 664.85.11.037 : 632.4
Fungi causing rots of apple fruits in storage in Northern Ireland.
Ann. appl. Biol., 1938, **25** : 88-99, bibl. 29.
Information on the fungi causing rots of apples in storage in Northern Ireland is meagre and the investigation recorded in this paper was made in order to bring the position into line with that of other countries. Forty species and strains were isolated of which 16 proved pathogenic to Bramley's Seedling, the variety chiefly grown. These 16 and the nature of damage caused by them are described.

587. Doidge, E. M., and van der Plank, J. E. 664.85.3 : 632.4
The fungi which cause rots of stored citrus fruits in South Africa.
Sci. Bull. Dep. Agric. S. Afr. **162** (Plant Industry series **20**), 1936, pp. 23.
A study of fungi found on stored citrus fruits in South Africa and of their geographical distribution. The fruit was obtained from different parts of the country and nearly 4,000 strains of fungi were isolated and maintained in culture for analytical investigations. The report is tabulated and brief notes are given on the various organisms found on rotting oranges and other citrus fruits.

588. Rubin, B. A., and Trupp, V. E. 664.84 : 581.192
Biochemical processes in the storing of vegetables. [Russian, English summary 13 lines.]
Bull. appl. Bot. Leningr. 1936, Ser. III, No. **15**, pp. 123-47, bibl. in text.
Storage trials are described here, in which the storage qualities of cabbage, onions, carrots and beetroots was studied. No definite conclusions were reached and further investigations are in progress. The authors indicate that the biochemical nature of increased ability to stand storage

does not lie in a lowered metabolism or in a reduction of the products of metabolism but in a break in the oxidation process.

589. White-Stevens, R. H. 664.84.53
Analytical observations on the changes of pectic substances and sugars in celery during cold storage.
Sci. Agric., 1936, **17** : 128-35, bibl. 9.

Speaking generally and assuming sugar content to be a major property of food value in stored celery the optimum duration of Golden Self Blanching (Tall Strain) celery in cold storage at 32° F. is between 60-100 days, after which its food value declines rapidly. In this attempt to correlate storage maturity with pectin and sugar changes of celery in cold storage at the above mentioned temperature, a detailed technique is given for the quantitative comparison of the different pectic constituents. There was no definite correlation between pectic hydrolysis and storage maturity apart from the cytolytic effects of storage pathogenes. Sucrose sugars show a marked increase in the early part of the storage period, ultimately declining with a simultaneous increase in hexose, which in turn reaches a maximum and then declines.

PACKING, PROCESSING, PLANT PRODUCTS.

590. Putterill, V. A.,* and Dreyer, D. J. 634.13-1.564
Pear packing experiments. Progress reports Nos. 2, 3 and 4 and summary of paper read at the Imperial Botanical Conference, London, 1935, entitled, **Damage encountered in pears packed in cases.**
Sci. Bull. Dep. Agric. S. Afr. **160** (Plant Industry series **8**), 1935 (received November 1937), pp. 117, bibl. 4.

No. 2 report deals with pear packing experiments in the 1933-34 season with pears packed in boxes of varying dimensions under commercial conditions and sent from S. Africa to England. Results were much more erratic than had been expected, but certain conclusions were reached. There was a serious amount of bruising due both to the pressure of fruit on fruit and of box on fruit. Bruising was less severe in slack boxes than in tight boxes. Reduction in bruising due to completely lining the boxes with corrugated cardboard appeared to be significant and the practice is, therefore, recommended. Seven varieties of pears were dealt with. No. 3 report deals with Glou Morceau and Kieffer pears packed in trays, half cases and cases, in the 1934-35 season and sent as before to England. Results with different packing methods are detailed. No. 4 report deals with the bruising and condition of Williams Bon Chrêtien and Beurré Bosc pears packed in single layer trays and 5 layer cases in the 1934-35 season. The single layer packs showed some 20% more sound fruits than the better of the two types of case packs used for comparison. Of the two types of case packs used that in which there were woodwool pads on the top of the fruit and at the bottom of the box gave better results than that in which corrugated cardboard liners were used. Other results of different packing methods are also noted. In the final summary the following subjects are discussed in the light of examination of sample consignments :—type of packing ; type of injury found in case packed pears ; extent of injury in commercial consignments ; extent of injury in relation to tightness of pack. The following conclusions are reached :—Case packing was introduced at the request of the trade. Serious objections are found to exist against packing to overflowing. Case packing results in severe bruising, in a considerable amount of abnormal ripening and in abnormally severe core breakdown. The use of woodwool pads (preferably) or corrugated cardboard liners combined with medium tightness of pack reduces bruising. It is suggested that wrapping the centre pears in oiled wraps and introduction of packing material into the centre of packs might diminish core breakdown. In the present state of knowledge some varieties can be case packed, provided they are not packed too closely and are protected from bruising by suitable packing material. But to achieve unblemished quality some varieties will never stand case packing.

* Report No. 2 only.

591. MCCLELLAND, G. L. 634.3-1.564 : 331.82
Parts played by light, color and eyes in packing house grading.
Calif. Citrogr., 1938, **23** : 195.
Natural daylight cannot be evenly distributed over the surface of the sorting tables. Surface glare at the window affects the visual organs of the operator to the extent of requiring 1 to 3 minutes for readjustment of correct vision. Properly arranged artificial lighting renders grading operations more efficient provided certain conditions are present; these are—an operator physically and mentally adapted to the purpose, a correct intensity of light, fittings so coloured that they do not absorb or enhance the true colour of the fruit, freedom from glare and proper situation in relation to the light, and the efficient shutting off of natural light in the visual field of the operator. The nervous system is stimulated by the red end of the visible spectrum, depressed by the blue end and is calm in the yellow portion. The colour of the conveyor bands and other fittings should, therefore, be in the neutral field. The influence of the colours of the surroundings on fatigue and efficiency is very great. The work of the operators examining citrus under the X-ray machines for crystallization, blossom-end decline or *Alternaria* is even more visually tiring because of the low light intensity, and rest periods of 5 minutes in every 20 are necessary. Among the physical qualifications necessary in an X-ray machine operator are good sight without glasses (which absorb an already low light intensity) and fast co-ordination between hand and eye for the timely operation of the kick-out lever on the appearance of a faulty fruit. Dark eyes usually have large pupils which let more light into the eye.

592. GREGORY, J. H. 588.427 : 631.564
Granadilla packing.
Qd agric. J., 1937, **31** : 406-11.
Maturity. For long distance transport the fruit should be picked when it has just taken on a golden green colour at the end. Where there is danger of fruit fly attacks the fruits can be covered with paper bags. *Harvesting.* Fruits should be removed with clippers leaving only a short length of stalk. *Packing shed equipment.* The fruit should be laid on a flat-topped table to cool. A thin padding on the table prevents abrasions. The fruit can there be sized. *Containers.* The tropical case, $24\frac{3}{4} \times 12 \times 12''$ is good. Of the bushel cases tried the standard case, $18 \times 11\frac{1}{2} \times 10\frac{1}{2}''$, is the best. *Packing materials.* White or coloured plain paper is used for wrapping the fruits and corrugated cardboard for lining the boxes. Woodwool is the most suitable material for padding purposes. *Packing.* Corrugated sheets with corrugations outside are placed on the bottom and at the sides and a layer of woodwool is put on the bottom. Each fruit is then paper wrapped and placed on the woodwool to form a layer. This is covered with woodwool which is also put in the crevices between the fruits. Packing then proceeds with alternate layers of fruit and woodwool. The fruit is always placed with the stalk end nearest to the sides so as to afford maximum protection to the flower end which softens first. Illustrations (16) are given of the packs, both crossways and lengthways, of the standard bushel case and of the tropical fruit case.

593. CULPEPPER, C. W., AND MOON, H. H. 664.85.13.047
Drying Kieffer pears and the use of the dried product.
Circ. U.S. Dep. Agric. **450**, 1937, pp. 24, bibl. 23.
The results are reported here of the tests made by the Bureau of Plant Industry in order to determine the effects of different methods of preparation upon the quality of dried products of ripened and unripened Kieffer pears. The following notes are taken from the authors' summary:—Kieffer pears, ripened at 60° F. for a sufficient length of time to give a pressure test of 2·5 to 3·5 lb. with the Magness pressure tester, made a dried product much superior to that produced from unripened fruit. When properly dried to a moisture content of 10 to 15% the ripened product was pliable, pale yellow in colour, and mild and pleasing in flavour when cooked. The unripened pears were hard, less flexible, of opaque grey or white colour, and tough and flavourless when cooked. The dried product of peeled fruit was superior to that of unpeeled fruit. Pears

dried without sulphuring were less attractive in appearance than those properly sulphured, but were superior in flavour after several months' storage. To sulphur properly the fruit had to be exposed to the fumes of sulphur dioxide for 2-4 hours, unpeeled needing much longer exposure than peeled fruit. Prior to drying slicing the fruit into eight radial segments is recommended. The dried product of the Kieffer pear readily absorbs moisture from the air. Therefore, regardless of the treatment received, it deteriorates rapidly in moist air. The rate and the total amount of change vary directly with the relative humidity. It was concluded that the moisture content of the material should be reduced below 10%, if an extended storage period was necessary. The material was found to deteriorate rapidly in atmospheres above 70% relative humidity. The dried product of the Kieffer pear is readily refreshed by soaking in water. The rate of absorption increases with increase in temperature. The rate at which water is absorbed is also very markedly increased by slicing the fruit into thin segments before drying. Graphs show the relationship of size of segment to the rate of water absorption. It is stated that except in areas normally having very hot dry weather during the late autumn months Kieffer pears cannot be dried with solar heat alone and that drying equipment employing artificial heat will be necessary.

594. JENKINS, W. J. 634.573-1.56
The cashew nut industry in Western India.
Bull. imp. Inst., Lond., 1938, **36** : 44-52.

The cashew industry in Western India is largely maintained by the collection of wild nuts in the Konkan forests in the south-western coastal districts of the Bombay Presidency. The possibilities of cultivation are being investigated by the Government, since at present a considerable tonnage of nuts for manufacture has to be imported. The consumption of the product, however, is almost entirely American and is being adversely affected by high tariffs. Further markets, preferably within the Empire, are therefore needed if the industry is to expand. The nuts have to undergo several processes after gathering before they can be marketed as blanched cashew kernels. They are roasted for 2 minutes in open pans or perforated rotary drums over flaming fires fed with the inflammable dry husks ; the nuts are soaked overnight in water before roasting in drums to reduce the chance of burning. The oil given off during roasting drains into a separate collecting receptacle. After roasting the nuts are dusted with wood ash and the husks then broken open and the kernels extracted by women who crack the nuts on flat stones with the aid of small wooden batons. This is a skilled operation, since the kernel must be extracted whole to maintain its commercial value. The thick yellow integument with which the kernels are covered is removed by baking at 70° C. for 4-6 hours. As this process renders the kernels brittle, they are softened after baking by the absorption of moisture from small tanks over which they are placed in a single layer in flat trays. They are then graded by hand and packed in hermetically sealed tin boxes in which the air is replaced by carbon dioxide. There are some valuable by-products. A fermented beverage (unlawful) and a vinegar (lawful) can be made from the apple. The oil extracted from the nuts during roasting can be used in varnishes, insulating coatings, moulding compositions, inks, and when painted on furniture, books, etc., will prevent damage from white ants. The oil is considered to be a specific against leprosy. The resinous gum exuded from the bark has insecticidal properties and is used as a tanning agent. The sap obtained from incisions in the bark is utilized as indelible marking ink. The wood has many local uses.

595. BENVEGNIN, L. 663.25
La préparation des vins rouges. (**Red wine making.**)
Reprinted from *Chron. vitic. suisse*, 18 and 25 September, 1937, pp. 20.

The author describes here the different processes of wine making. The difference between the methods of preparing red and white wines is discussed briefly and notes on harvesting grapes are given.

596. Byrne, J., Saywell, L. G., and Cruess, W. V. 581.192 : 663.25 + 634.851
The iron content of grapes and wine.
Industr. engng. Chem. (*anal. Ed.*), 1937, **9** : 83-4, bibl. 10.
The iron content of a large number of samples of juice of *vinifera* vines grown in California, of wine made from similar grapes in glass and of commercial wines made in California was determined and results are here tabulated and discussed. The iron content of the juice ranged from 1·5 to 23 p.p.m. This decreased during fermentation from an average of 9·0 p.p.m. to an average of 1·8 p.p.m. This was not affected by the addition of sulphur dioxide during fermentation. The fact that there was about 3 times more iron in commercially made wines than in wine made in glass in the laboratory indicates solution of iron by juice and wine from iron equipment.

597. Benvegnin, L. 663.813
De l'utilisation non-alcoolique du raisin en Suisse. (**The use of unfermented grape juice in Switzerland.**)
Reprinted from *Rev. suisse Hyg.*, année 1937, Fasc. 9, pp. 12.
Other uses of grapes than for wine making are described here. The author deals with table grapes, with non-fermented grape juice and juice extracts. A brief outline is given, without illustrations, of the process involved in the production of unfermented grape juice.

598. Fernbach, A., and Warcollier, G. 663.3
Les progrès de la cidrerie et les travaux de la station pomologique de Caen. (**The progress in cider making and the work of the Caen pomological station.**)
C.R. Acad. Agric. Fr., 1937, **23** : 1010-14.
In this article a brief account is given of the work of the Caen pomological station since its establishment in 1901 up to the present day. It is interesting to note that the last French agricultural statistics in 1929 set the value of the apple and pear production for cider at 1,426 million francs per year and that of dessert varieties at only 782 million. Investigations have embraced the following :—methods of processing apples, fermentation methods, every phase of cider making, the manufacture of apple spirit, utilization of waste products and purification of waste liquid. It is noted that at present the research station has no orchard of its own and that a resolution was passed at a recent International Congress on Pomology and Cider Making favouring the establishment of such a valuable adjunct.

599. Fernbach, A., and Warcollier, G. 663.3
Procédé de fabrication de cidres doux en fûts. (**Method of producing sweet cask cider.**)
C.R. Acad. Agric. Fr., 1937, **23** : 934-43.
In this paper Warcollier, director of the pomological institute at Caen, describes briefly the processes involved in the production and storage of sweet cider with special reference to that evolved by incomplete fermentation. First he discusses those ciders which naturally keep sweet without any special treatment and in which fermentation proceeds only very slowly. Such ciders are generally made from particular varieties such as Domaine, Joly Rouge, Cimetière, Gagnevin, Mettais, etc., grown generally in soils which are poor in calcium and clay fractions, often siliceous and full of pebbles, or again in decalcified soils which have suffered transformation into siliceous clay or in soils with a schistous subsoil. The characteristic of the apples concerned is their low nitrogen content. Next he discusses the artificial processes which can be used to preserve cider in a sweet condition and details one of the methods evolved by himself for this purpose and the principles involved.

600. Roberts, J. A., and Gaddum, L. W. 663.815 : 581.192
Composition of citrus fruit juices.
Industr. engng Chem., 1937, **29** : 574-5, bibl. 2.
The authors analysed the juice and the ash of samples of the following citrus fruits received from named sources in Florida :—Seedling orange, blood orange, Valencia orange, Lue Gim Long

orange, Marsh Seedless grapefruit, common grapefruit and tangerines. Their analyses are here tabulated. Analytical results concern first the ordinary data with regard to such matters as citric acid, degrees Brix, pH, sugars, etc., and secondly the amounts of various elements present to any important extent in the juice and in the ash, the actual number of elements determined in the ash being 29. Further details are given of the alkalinity of the ash and of the spectrographic examination of the precipitates used in the analysis.

601. JOSLYN, M. A., AND MARSH, G. L. 663.813
Utilization of fruit in commercial production of fruit juices.
Circ. Calif. agric. Exp. Sta. **344***, 1937, pp. 61, bibl. 65+9 journals.
The information presented here is based on investigations made by the staff of the Fruit Products Laboratory of the University of California, and contains practical directions for commercial and farm-scale preparation of fruit juices and fruit-juice beverages. Attention is drawn to the good list of recent, almost entirely American articles on the subject.

602. GURNEY, E. H. 631.556.1 : 581.192
Composition of some fruits and fruit waste.
Qd agric. J., 1937, **31** : 403-5.
Fruits were taken direct from the market and analysed by the Department of Agriculture. The analysis of different parts, often including seeds or skins, of the following fruits, sometimes including several varieties, is given here :—plums, pawpaws, cherries, peaches, apricots, bananas, passion fruits, figs, persimmons, mangoes, pears, apples, egg fruits, jack fruits.

603. FELLERS, C. R., MILLER, J., AND ONSDORFF, T. 664.162 : 664.84/85
Dextrose in the manufacture of fruit and vegetable products.
Industr. engng Chem., 1937, **29** : 946-9, bibl. 22.
A table is given based on experiments made in the last $2\frac{1}{2}$ years showing the suitability of dextrose for use in the preparation of canned and variously packed fruit and vegetable products in conjunction with sucrose. The advantages of dextrose and precautions necessary when using it are discussed.

604. DEIJS, W. B. 633.72 : 545.81
Colorimetrisch onderzoek van den theeschenk met behulp van den Pulfrich-photometer. (**Colorimetric investigation of tea-extract by the use of the Pulfrich-photometer.**) [English summary.]
Arch. Theecult. Ned.-Ind., 1937, **11** : 293-307, bibl. 4.
Investigations are described which demonstrate that the determination of colour by means of the Pulfrich colorimeter is a suitable method for expressing the colour of tea liquor in figures. The influence on the colour of the liquor of certain conditions between plucking and the completion of manufacture is discussed.

605. TATARSKAYA, R. I. 633.72 : 581.192
Methods for the determination and isolation of tannase preparation. [Russian, English summary 20 lines.]
TATARSKAYA, R. I.
The rôle of certain groups of micro-organisms in the process of the working up of tea leaves. [Russian, English summary 4 lines.]
TATARSKAYA, R. I.
The oxidase of tea leaves. [Russian, English summary 12 lines.]
Bull. appl. Bot. Leningr., 1936, Ser. III, No. **14**, pp. 117-48, bibl. $1\frac{1}{2}$ pp.
Three articles dealing with the chemistry of tea leaves.

* Superseding *Circ.* 313.

606. MILSUM, J. N., AND GEORGI, C. D. V. 665.353.4
Small scale extraction of palm oil.
Malay agric. J., 1938, **26** : 53-8, bibl. 1.
A description is given of a hand-press now adopted in Nigeria for the extraction of palm oil on small holdings. It is thought that this press, holding about 150 lb. of fruit, would prove useful in Malaya, though not more than a 72% oil recovery could be expected compared with the 90% obtained with estate machinery. The estimated annual yield of oil from 40 acres would amount to about 23 tons, or 11·5 cwt per acre per annum compared with 15 cwt per acre per annum which would be obtained if the fruit were treated in an estate factory. Ten acres is thought to be the minimum acreage with which the press might profitably be used. The method of working the machine is described.

607. COOKE, F. C. 634.71
The practical aspects of copra deterioration.
Gen. Ser. Dep. Agric. S.S. and F.M.S. **28**, 1937, pp. 49, bibl. 20.
The author deals with copra deterioration in F.M.S. and measures for its prevention. Notes are given on the marketing of copra and considerable attention is paid to grading in the field, in the laboratory and in commerce.

608. ENDERLIN, L., AND LE BRAS, J. 665.117 : 633.912
Production et utilisation des torteaux d'Hévea. (**Oil cake from *Hevea* seed.**)
Rev. Bot. appl., 1937, **17** : 175-87, 268-77, bibl. 82.
Of this lengthy and comprehensive article it is not possible to do more than indicate some of the chief points. *Yield.* A full grown *Hevea* bears annually about 1·250 kg. of seeds. 50% of the total weight of the seed is contained in the kernel and when crushed the latter provides 44% oil, 50% cake and 6% waste. *Harvest and storage.* The fallen seeds are picked up from the ground. Seeds must be dried before storage or the oil will be acid and the cake unusable. *Treatment of seed.* Discussion here is on decortication, drying, packing, transport and cake manufacture. A recently patented method of packing consists of a preliminary steam sterilization followed by sufficient compression to mould the seed into compact blocks of about half the bulk of loose seeds. In manufacture the oil is extracted by expression or by solvents. *Analysis :* The composition of the cake is discussed. *Uses.* Experiments in feeding the cake to cattle are noted. The most practical of these were carried out by the Imperial Institute in collaboration with the Agricultural College, Wye. From these it appeared that, while full grown cattle thrived on the cake with no ill effects on either growth or milk yield or quality, young beasts could only take a limited ration. *Comparison with linseed cake.* Certain dangers attendant on the use of linseed cake are discussed. It is concluded that any ill effects from either cake are due to faulty preparation before feeding and instructions are given as to the correct method. *Economics and the problem of finding a market.* This section deals with cost of production and prices. There is still prejudice to be overcome, although any differences between linseed and *Hevea* cake are in favour of the latter. *Manurial value.* Certain experiments have shown this to be considerable, but so far all efforts have been directed to its alimentary uses.

609. UNDERKOFLER, L. A., MCPHERSON, W. K., AND FULMER, E. I.
635.24 : 663.8
Alcoholic fermentation of Jerusalem artichokes.
Industr. engng Chem., 1937, **29** : 1160-4, bibl. 20.
The data here presented show that the Jerusalem artichoke, *Helianthus tuberosus*, is an excellent raw material for the production of industrial alcohol. The aqueous extract produced from the artichokes by diffusion provides a very good medium for alcoholic fermentation with the help of yeast and the extraction of fresh tubers or desiccated chips presents no serious difficulty. Methods of preserving the diffusion extract and of storing the artichokes after desiccation are described.

610. Ozirsky, V. I. 633.812 : 581.192
The chemical differentiation of individual shrubs of vegetatively raised geraniums. [Russian, English summary 1 p.]
Bull. appl. Bot. Leningr., 1936, Ser. III, No. **13**, pp. 31-53, bibl. 33.
In 1934 and 1935 trials were made with *Pelargonium roseum* hort. at Sukhum and Detskoye Selo from which the following conclusions were reached :—1. A very significant range in variability was found to exist both in the yield of chemical compounds isolated and in their composition. 2. An observation was made that an influence acting upon the fermentative apparatus may in itself affect both the percentage yield of essential oil and its composition. A significant increase in the amount of essential oils and a variation of the alcohol content in the oils of the plants resulted from application of chemical agents such as carbon monoxide. 3. Different results were obtained with the same form of geranium at Sukhum and Detskoye Selo, as regards the amount of oil content and composition of oil in the plants. 4. Amphidiploid plants under field conditions raised from cuttings, were found to produce a greater number of leaves, a slightly higher yield of oils and a higher percentage of alcohols than *Pelargonium roseum*. However, if amphidiploid plants were obtained in the first year from seedlings, the number of leaves and the oil content were significantly lower than from plants obtained from cuttings of subsequent years. Therefore, the author concludes, growing geraniums from seed cannot as yet be recommended. The report is graphed, illustrated and tabulated.

611. Urinson, R. P. 633.812 : 581.192
Studies on the chemical composition of the essential oils of mutants of the geranium *Pelargonium roseum* hort. [Russian, English summary ½ p.]
Bull. appl. Bot. Leningr., 1936, Ser. III, No. **13**, pp. 67-85, bibl. 38.
For several years chemical analyses have been made of the essential oils of mutants of *Pelargonium roseum* hort. at the Laboratory of Specific Synthesis, Department of Biochemistry of the U.S.S.R. Institute of Plant Industry. The conclusions reached may be summed up as follows :—1. Mutation changing the morphological characteristics of plants was not found necessarily to induce changes in the direction of chemical processes occurring in plants. 2. Mutation shows itself in the rapidity of formation of various components of the essential oil, thus eventually changing the quantitative composition of the latter. In the present analyses various mutations of the geranium, obtained by means of cuttings, induced an increase of total alcohol in the essential oil. 3. Polyploidy was not found to have a definite effect on the quantitative ratio of individual alcohols in the essential oils, but was observed to be accompanied by a total increase of alcohol content. 4. The presence of stereoptenes in the oils of the mutants *P. roseum* No. 5 and *P. roseum* No. 14 is explained by a partial reversion of the original *P. roseum* to the conjectured parent species *P. graveolens* under the influence of mutation. 5. For industrial purposes, the newly bred *P. roseum* No. 14 is said to be the most valuable variety. It was obtained as a result of mutation. *P. roseum* No. 14 is stated to equal in productivity, acclimatization and yield of essential oil even the most outstanding varieties obtained by selection such as *P. roseum* No. 5 and *P. roseum* No. 1, and to surpass these in the quality of its essential oil owing to a higher content in citronellol which is the most valuable component of the essential oil of geranium.

612. Pravdolyubova, A. A. 633.812 : 581.192
On the composition of the essential oil of *Pelargonium capitatum* No. 24, and *Pelargonium Radula* No. 29. [Russian, English summary 6 lines.]
Bull. appl. Bot. Leningr., 1936, Ser. III, No. **13**, pp. 87-9.
In 1932 at the Sukhum Department of the U.S.S.R. Institute of Plant Industry analyses were made by the author and V. I. Nilov of the essential oil of *Pelargonium capitatum* No. 15. Investigations showed that the essential oil of this geranium hybrid contained 80% capric acid. In analysis of the essential oil of the constant species *P. capitatum* No. 24 and of that of the parent form *P. Radula* No. 29 no capric acid was found. This, the author states, confirms the hypothesis that the capric acid first appears as a result of hybridization.

613. KIR'YALOV, N. P. 633.812 : 581.192
The chemical composition of the essential oil of the new species of anise "Anisette", *Pimpinella anisetum* Boiss. [Russian, English summary 10 lines.]
Bull. appl. Bot. Leningr., 1936, Ser. III, No. **15**, pp. 241-4, bibl. 5.
Analyses were made of the essential oil of anisette (*Pimpinella anisetum*) at the biochemical laboratory of the Institute of Plant Industry. The plants analysed were grown in U.S.S.R. from seeds obtained from Turkey. The essential oil of these plants contained 84-87% anethole, 12-15% methylhavicol and 0·5-1% of an unknown product having a high boiling point. This product is probably a mixture of a small amount of anethole and sesquiterpene. The author forecasts that anisette will become a serious competitor of anise as a raw product for the anethole industry, owing to the high percentage of oil in the seeds, the large amount of seed yielded per plant and the high anethole content in oil, as well as to a number of other economically valuable characters.

614. SNEGIREV, D. P. 633.85 : 581.192
Changes in the chemical composition of essential oils brought about by hybridization. [Russian, English summary 25 lines.]
Bull. appl. Bot. Leningr., 1936, Ser. III, No. **15**, pp. 245-74, bibl. 27.
The chemical composition of the essential oil in *Ocimum canum* and *Ocimum gratissimum* and in the F_1 hybrids from a cross of these two species was studied at the biochemical laboratory of the Institute of Plant Industry, Leningrad. The physical and chemical properties of the soil in the F_2 hybrids were also determined, and variations in the content of camphor and eugenol were noted. The essential oil in *Ocimum canum* consisted of α-pinene, camphene, dipentene, d-camphor (54-57%), α-terpinene and traces of eugenol and bisabolene. In the oil of *Ocimum gratissimum* there were found ethyl-isovalerate, ether, cineol, eugenol (16·52%) and bisabolene (54%). The oil in the F_1 hybrids is characterized by the presence of the same constituents as are found in that of the parental forms. The camphor content in the oil of the F_1 hybrids was found to range from 5·05 to 26·86% ; the eugenol content from 4·74 to 28·83%. It was observed that a high eugenol content has often coincided with a high content of camphor. The chemical composition of the oil in the F_1 hybrids from reciprocal crosses was identical. The specific gravity of the oil in the F_2 hybrids ranged from 0·9110 to 0·9647, the refractive index ranged from 1·4700 to 1·4988, and the optical rotation from −3·60° to +46·46°, indicating that the composition of the oil in these hybrids had undergone profound changes. The camphor content in the oil of the F_2 hybrids was found to range from 0 to 46·98% ; the eugenol content from 0 to 39·67%. The composition of the oil of some plants among the F_2 hybrids did not differ much from that of the initial forms.

NOTE ON REPORT.

615. GARNER, R. J., AND WALKER, W. F. 631.541.44 : 634.1/2
The frameworking of fruit trees.
Occas. Pap. Imp. Bur. Hort. **5**, 1938, pp. 19, bibl. 26, 1s.
The authors after discussing previous work on methods of effecting quick varietal changes in the orchard, give a full account of four practical methods of frameworking which they designate as stub-grafting, side grafting, inverted L bark grafting and awl grafting. Line drawings greatly facilitate an understanding of the methods. Notes are made on suitable grafting wax and wound dressings, on the after-care of worked trees and of likely costs and returns.